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AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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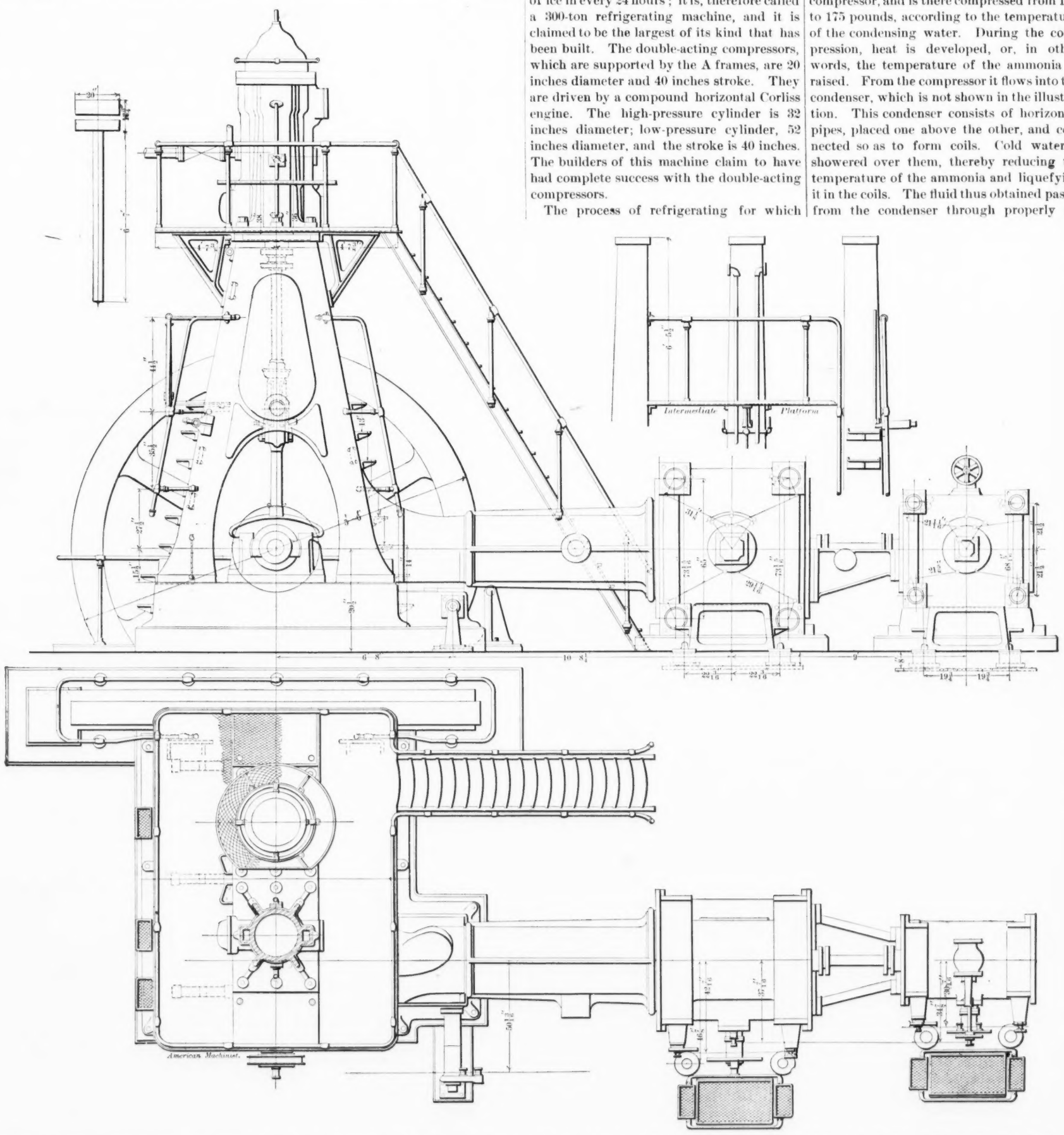
A 300-ton Refrigerating Machine.

During recent years the progress of the manufacture of ice has been very rapid in this country, and the indications are that before very long the failure of ice crops need to be of no concern to consumers, as it has been in the past. Ice is not only made at present in the southern States in cities and small towns, but some of the large northern cities are also coming into line.

The refrigerating machine, of which we give an illustration, is a notable example of what has been accomplished in this line of machinery. This machine has just been completed by the De La Vergne Refrigerating Machine Company, 138th street, New York, for the Pabst Brewing Company, of Milwaukee, Wis. The machine is capable of compressing the ammonia necessary to do an amount of refrigeration equal to 300 tons of ice in every 24 hours; it is, therefore called a 300-ton refrigerating machine, and it is claimed to be the largest of its kind that has been built. The double-acting compressors, which are supported by the A frames, are 20 inches diameter and 40 inches stroke. They are driven by a compound horizontal Corliss engine. The high-pressure cylinder is 32 inches diameter; low-pressure cylinder, 52 inches diameter, and the stroke is 40 inches. The builders of this machine claim to have had complete success with the double-acting compressors.

The process of refrigerating for which this machine is used is exceedingly simple, and substantially consists of three operations, following each other in rotation, namely, the compression of ammonia; second, its condensation; and lastly, its expansion. Omitting the minor details, we may describe the operation as follows: The ammonia, in the form of a vapor, flows into the compressor, and is there compressed from 125 to 175 pounds, according to the temperature of the condensing water. During the compression, heat is developed, or, in other words, the temperature of the ammonia is raised. From the compressor it flows into the condenser, which is not shown in the illustration. This condenser consists of horizontal pipes, placed one above the other, and connected so as to form coils. Cold water is showered over them, thereby reducing the temperature of the ammonia and liquefying it in the coils. The fluid thus obtained passes from the condenser through properly adjusted cocks into coils of pipe placed in the refrigerating room. The pressure in these last coils is maintained at a lower point than



that required for retaining ammonia in a liquid state. The liquefied gas, upon entering these last coils, re-expands against a pressure, and its temperature is still more reduced, and extracts from the pipes and the substances surrounding the pipes the same quantity of heat that was previously given up by the gas to the water used during the period of condensation and liquefaction. The gas having performed, in this last operation, its refrigerating work, and its pressure being reduced, varying from 10 to 30 pounds above that of the atmosphere, is now ready to re-enter the compressors and repeat the same cycle of operations.

The operations are, in effect, that of taking the heat out of the refrigerating room, adding heat to that by the compressor, and finally causing both heats to be carried away by the water, which was showered over the condenser.

The principle of the operation of all refrigerating machines is essentially the same. The gas, or vapor, is condensed; it is deprived of its heat, thereby diminishing its volume; its temperature is lowered by doing work, and it is then expanded. During the last operation heat is supplied by the articles to be cooled, whereby the refrigerating effect is produced.

The mechanical difficulties encountered in pumping ammonia may be stated as threefold in number, and are as follows: 1. The imperfect discharge of the gas from the pump. As a clearance must necessarily be left between the piston and the cylinder head, only a portion of the compressed gas, in ordinary compressors, is expelled at each stroke; that remaining is re-expanded with the reverse motion of the piston, and thereby produces a pressure against the incoming charge of gas, and causes a loss of power and efficiency. 2. Leaky stuffing-boxes, piston and valves. If an attempt is made to procure tight joints with an ordinary stuffing-box, the friction due to the tightening of the stuffing-box will be very great; in fact, it is claimed that in some cases the power required to overcome this friction was found to be more than sufficient to do the entire work of compression. Again, working against constant pressures of 125 to 175 pounds necessitates the use of a tight piston; the least wear will cause a considerable leakage of gas past the piston. Similar difficulties will also be encountered with ordinary valves, causing the gas to reenter the pump past the discharge valve, or be returned to the suction side past its corresponding valves. 3. Heat of compression. The mechanical energy which the compressor piston exerts upon the gas is converted into heat, which tends to expand a tight packing of the piston, thereby causing friction, while, on the other hand, a loose packing of the piston, or its eventual wear, allows the gas to slip past.

After much experimenting, the De La Vergne Refrigerating Machine Company have overcome these difficulties by injecting into the compressor, at each stroke, a certain quantity of oil which effectually seals the stuffing-boxes, pistons and valves, fills all clearances, and takes up the heat developed during compression. This system enabled the builders to adopt a double-acting compressor, which can handle the gas in connection with the circulation of oil. These compressors are now used to a great extent, have fully met the expectation of the designers, and have given results very satisfactory to the users of the machine. It must be apparent that a double-acting compressor has its advantages; it can handle double the amount of gas with every revolution of the crank-shaft that a single acting compressor does, which has the same diameter and the same stroke; the friction is reduced for an equal amount of work, thereby power is saved, and enables the builders to build a machine at a reduced cost. The design of the compressor is such as will discharge the oil after all the gas has been discharged, otherwise re-expansion of the gas will take place, and would produce a loss of efficiency.

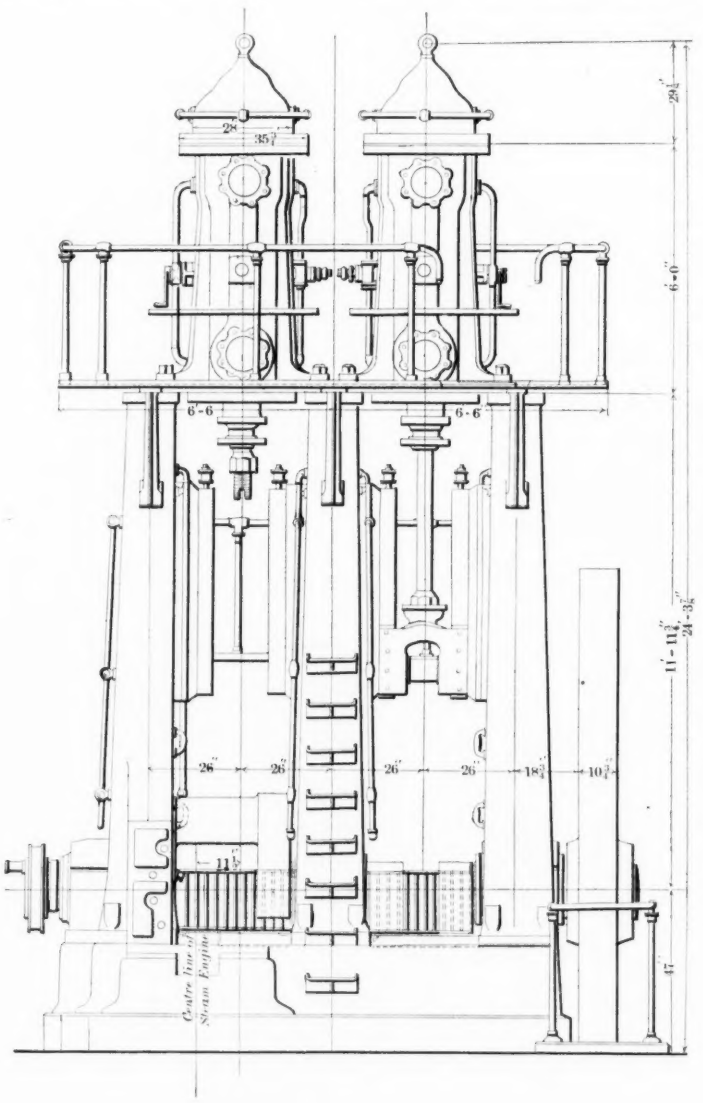
The ammonia and oil go through complete cycles, during which they are separated, and there is practically no waste by leakage or otherwise, they will remain in the system for a long period without supplement or renewal.

The machine here illustrated weighs about 225,000 pounds, and although it is the largest one the company has constructed up to the present time, they have now in course of construction a machine that will compress ammonia necessary to do an amount of refrigeration equal to 500 tons of ice in every 24 hours.

Some Rolling-mill Notes.

BY C. O. SINE.

In the first letter under the above heading, the engines and machinery were spoken of. To-day I have the engineers for a topic. At least I will begin with them.



Plan of Intermediate Platform.

REFRIGERATING MACHINE.—SEE PAGE 1.

There is not an engineer for every engine in these works, one engineer and his oiler being able in one instance to keep up eight engines and three pumps, the engines varying in size from 500 H. P. to 10 H. P. When the mills run "double turn" (night and day) as they usually do, there are, of course, two engineers who relieve each other morning and evening during the week, both coming out Sunday morning to see that the boilers are properly cleansed, to pack and key up, adjust packing rings, renew leaky joints, etc. In fact, Sunday—as much as it ought to be a day of rest—is really some of our engineers' "busy day." Sunday work has been very materially reduced by making substantial repairs on the engines, thus requiring less attention than before. Some of our engineers who have been deprived of their Sunday work by the repairs above stated, mildly object to it, for no other reason than the consequent loss of money to them, for they all work by the day, and no Sunday work means a reduction of nearly 15 per cent.

Our engineers do not stop and start any but the "big engine," unless they are at one of the smaller ones when they are to be stopped or started; this is usually done by some one of the men who operate the machinery driven by the engine, and generally very satisfactorily, but in two instances disastrously. The first accident happened as follows: The night man at the ore crusher failed to put in an appearance at the usual time, so the most promising looking laborer from the yard was detailed to take his place. All that was required of him was to throw ore into the crusher from one pile and shovel it on to another after it came through the crusher. If anything went wrong with the engine or crusher he was to go for the nearest engineer, a distance of about 150 yards. Well, everything went smoothly (if such language is applicable to an ore crusher) till about 2 A. M., when the new man thought the engine was making too much noise, and as the noise was increasing in volume he concluded to go for the engineer, who, upon being waked up, took his hammer and monkey-wrench and lamp, and started with the new man for the ore crusher engine, which was located in a shed at the end of the stock-house. Before they got to the shed they heard steam escaping in large quantity (the new man observed that this was not the kind of noise she was making when he left her), which would preclude the possibility of doing anything until the steam was shut off at the boilers. This being done, and time given for the pipe to empty itself of steam, and the fog to clear away, the two men went in and found the perfect wreck of what had been an 8″x12″ upright engine. The key had been loose in the crosshead end of the connecting rod, and was the cause of the noise that the new man heard. During his absence it had come out, and the engine hammered itself to pieces, requiring a new crosshead, slides, cylinder head, piston and rod-crank, and a variety of small parts, before the engine could be called whole again.

Since this accident, if a new man is put on he is shown how to shut down, and is instructed to do so as soon as he has reason to think everything is not O. K. A split pin in the point of keys that are liable to come out is "an ounce of prevention" now practiced here.

The second accident was caused by a young man who had been employed but a few days helping shear iron. He had seen other men who worked at the shears start the engine (a 6″x12″) by opening the throttle and then turning the fly wheel. It is supposed that this young man was prompted by curiosity to start the engine one day while there was no iron to shear. Whatever his motive, he started the engine the same as he had seen it done, but did not let go of the fly wheel when the crank was off the center, but was carried over with the wheel, and crushed between it and a brick wall on the other side. He lived but a short time after being found, and nothing more can be positively known about it. It proves, however, that the simplest operation is dangerous when undertaken by the inexperienced or uninformed. It is presumed that it was curiosity that prompted the young man to start the engine, or he may have been impressed with the idea that he was a "born engineer," and needed no training or preparation of any kind to be a successful engineer. In support of this conjecture, I will say that every five or six years a young man comes in the shop and applies for a lathe job. In reply to my inquiries he informs me that he has "never worked in a machine shop, but that he has read the *S*—— *A*—— and can run a lathe as well as anybody can." I let one of these applicants try his luck, giving him an old mandrel to turn down to a shrinking fit for a collar. He put the mandrel in the lathe without a dog, and then tried to screw it up tight enough in the centers to carry a cut. The boys began to poke fun at him, and soon got him so confused that he put on his coat and left. He was a failure as a machinist, but a success as a spark car conductor from the start.

As illustrating the high opinion some men have of their abilities, I will relate an incident that occurred about eight years ago. Our nail factory was in operation at that time, and to those who had not seen anything of the kind it was quite a curiosity to see the ease and rapidity with which they were made. Briefly stated, a cut nail machine consists of a pair of shear knives, a pair of dies, a header, a nipper, and a gauge. Of course there are many other parts, but these are the principal ones. The plates from which the nails are cut are in width the length of the nail, and from 12″ to 16″ long. In most factories these plates were machine fed, but in ours they were hand fed. The plates are held by a pair of "nippers" on a feed rod. The rod is about ⅞″ diameter and 3 feet 6 inches long. It is supported at the back in a "rest" in such position as to give the desired taper to the nails as they are cut off. The feeder turns the plate over for each nail, and as the knife comes up slides the plate under it against the gauge, which determines the amount cut off for each nail. The knife and gauge together carry the piece cut off down to the dies, where the "nipper" holds it till the dies grip it. During the time it is in the dies the head is made, the nipper, beside holding the nail in position for the dies, also acts as a cleaver for the dies. The moving knife travels

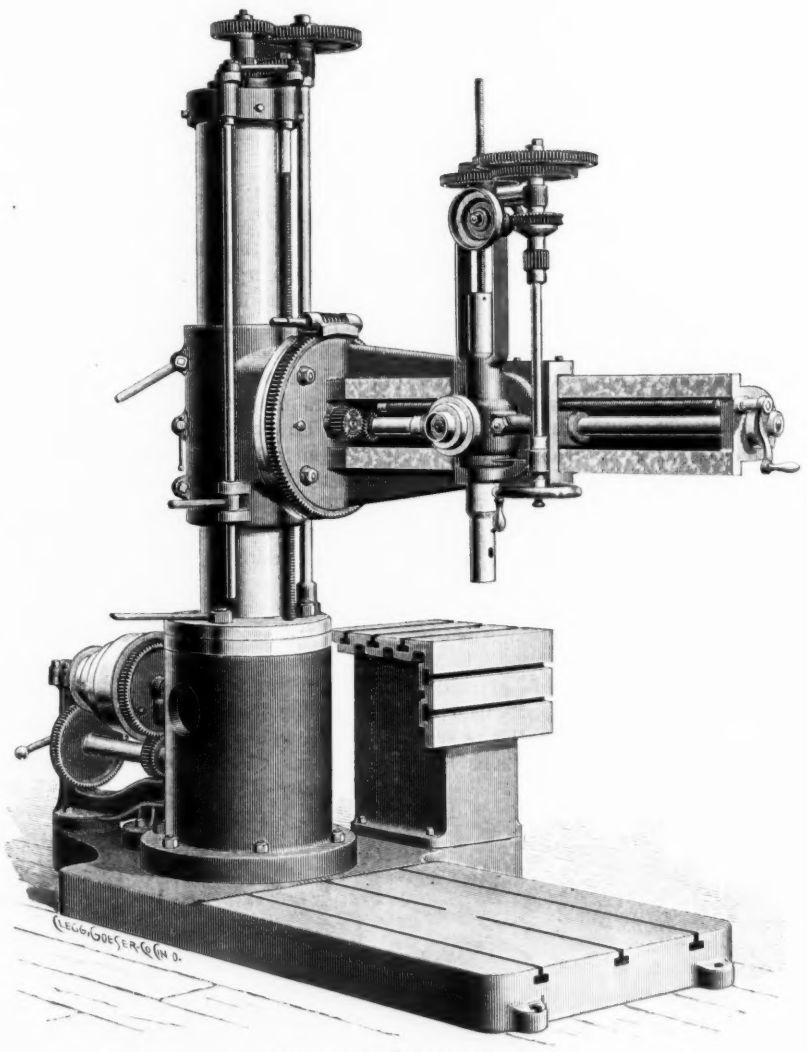
about 1½", about ½" above the bed knife, and during the time it is above the bed knife the plate must be fed in. This is very easily done at a speed of 250 revolutions per minute when one knows how and has had the necessary practice. The boys who fed the machines were always willing to let visitors try their hands feeding, so while showing the M. M. of a new road through the nail factory, one of the boys politely offered him a chance to feed. Seeing that he was inclined to try it, I jocosely remarked that I would catch the nails that he would cut, and he could present them to his friends as souvenirs. He then mounted the stool the boy had just vacated for him, and after getting the plate in the nippers to suit him he began to feed, much to the amusement of the factory operatives. After many vain attempts to get the plate under the knife, and cut at least one nail, he wiped the perspiration from his face, dismounted, and beckoned me to follow him out of the factory. Once outside of the factory he told me how surprised he was at the failure he had made. I asked him if he supposed he could feed nails without any practice, and he said he would have bet anything that he could have cut them as well and with the same ease that the boy did. I was as much surprised at this remark as he was at his inability to feed nails, for I knew it took a bright boy six weeks to learn to feed fairly well. Attempting that which cannot be reasonably accomplished is a prolific source of failure.

Universal Radial Drill.

The accompanying illustration shows a new radial drill which has recently been placed on the market by the Bickford Drill Company, of Cincinnati. Its distinctive features are a heavy bed plate which is thoroughly ribbed inside to secure rigidity, and bolted to this is the large round base of the column, to which is fitted the column itself, which is really a sleeve having a bearing at top and bottom, and resting on a flange through which pass three binding bolts which are about at the level of the top of the table.

Power is taken from the countershaft to the cone pulley at the rear where the back gears are placed, and from here it is taken by bevel gears to a vertical splined shaft, which by other bevel gears drives the shaft which runs along the arm.

This arm is of the box type, besides which it is braced both above and below, as shown. It is attached to the sliding sleeve in such a way that it may be turned to any angle by means of the worm shown, in addition to which the drill head also turns to any angle, and, as the column can be turned completely round, holes may be drilled at any point within the range of the machine, vertically, upwards or downwards, or at any angle in any direction. The arm rests upon a ball bearing which enables it to be turned very easily. It raises and lowers by power. Various sizes of the same general proportions are built by the makers as above.



UNIVERSAL RADIAL DRILL.

Over-confidence—English Watch Making.

BY W. H. BOOTH.

I have observed a general tendency in all people who have once come out at the top of the list to get into ruts, or rather keep in the groove wherein they achieved their success, remaining oblivious to the fact that others were following on in other grooves, and either catching up to or passing them, unseen, and, till too late, unnoticed. A familiar instance is that of English stationary steam engine makers. For so many years had we kept an easy first that we become too certain of our pre-eminence, and in the mean time American and some European countries were drawing up.

Though in marine engines and large mill engines I believe we are still first, there is a class of steam engines in which other nations have come at least level in respect to design. I refer to what may be called stock sizes, engines built of small size in quantity, like sewing machines or lubricators. In this special class English makers have had quite a stirring up during the past few years, and have been compelled to bestir themselves under the influence of such foreign design as seen in the Salzer engine or the Straight Line.

Reading Mr. Webster's article on punches and dies, and his remarks on English watch making, seems to show that American watch makers are liable to make the same mistake as the English engineers made, or as the English watch makers also made.

The adaptation of machinery to watch making—and I have seen the drawings of the first machinery for watch making on the modern principle, which were offered to and refused by English makers, and accepted later by Americans—is quite modern. This machinery gave American watch making such a start over the old-time methods that watch making in England fell to very small proportions under American (and Swiss) competition.

Mr. Webster, however, is mistaken, if he thinks that this start can be maintained without effort, for he is evidently unaware that, five years ago (to my knowledge,) watches were being made here by machinery, not merely as in America, but, I was informed, actually carrying the process a step beyond what was practiced in America. It is five years since I was invited to go through a watch factory, and, like Mr. Webster, I had been under the impression that English watch making was all on old-fashioned lines. The manager of the factory, who took us round and explained things, said, in reply to my question as to whether his factory was equal to American factories, that he carried things further, and to greater perfection of detail.

The wheel blanks were all punched out at one operation, and every piece to be machined chucked in such a way, and with such a pressure, that no injury could occur, the chuck-tightening screw having a friction head which could only be used to give a certain nip.

I believe it was in the turning of the spring barrels that we were told a higher finish was given than was given by American makers; every barrel was turned twice, all over, first to reduce it very nearly to size, after which it was left to rearrange itself on being relieved of its outer skin, and then, when thus slightly warped, it was skimmed up with an infinitesimal cut. If I recollect rightly, this second truing up was a refinement not found (at that time) in America.

Not being a watch maker, I spoke, of course, a different language from my friend, and so I asked him to give me, as an engineer, some actual fact which I could comprehend, as forming to me an understandable material point in support of his contention that he beat Americans on their own specialty.

A few months before this I had purchased an American watch—a lady's watch of fair size—and at the time of my visit to this factory this American watch had been regularly wound daily, and kept without variation, exactly, with a public clock daily rated from Greenwich. It had kept time for months to a second, after a little regulation. I had thus very substantial reasons to believe in American watches. As I put my question, we were near a bench where a man was doing something with parts of the escapement, and picking up a little slip of flat steel about ½" long, which I perceived to be the pallet piece, he asked me to examine it.

I did so, and noticed that though it was not $\frac{1}{32}$" thick (probably not $\frac{1}{40}$") it was slotted at each end a short distance up. Between the sides of these slots, explained my guide, are fitted the pallet jewels, which are thus not merely cemented in, but also held in a more positive manner by their steel flankings. Then he went on to explain that the Americans did not slot the steel, but relied on cementing alone, and said further, American watches fail there, for the pallet jewels get loose; ours never do.

It seemed a small item, but I was soon afforded a curious commentary upon his statement, for after keeping exact time for a whole year, Mrs. Booth's American watch went wrong one day, and on having it repaired, I was informed that one of the pallet jewels was a little loose. Never since then have I been able to get so exact a regulation as was given it by a Cornish man in half an hour's detention; but had these pallets been in slots, I believe the watch is otherwise practically perfect. Quite possibly American makers now slot the pallets, but the fact remains, they omitted a detail of importance. I was informed that the very best possible watch was a machine-made one, with a certain amount of hand finish superadded; also that for cheap watches the Swiss had decidedly the lead, for moderate prices the Americans, and for better work "no one can touch us," but for the very highest finish, he awarded the palm again to the Swiss.

That day's inspection of machine watch making was one of the best days ever I spent, and quite a revelation to me of another world, as well as completely subversive of my idea that no machine watch trade existed with us.

Thus it is that I feel disposed to put Mr. Webster into the category of *too secure*, along with so many of our old engine builders.

It is a curious fact that the town of Coventry, once so famous as a watch making center, and which began to grow grass in its streets, has now more than regained its prosperity—not merely because it is again to the fore in watches, but because it is the center of a new trade—bicycle making, for which small and light work its idle watch makers seemed to have a special fitness.

Some correspondents discuss files. A file has as good a right as any other tool to be made of good steel. English files are made of as good steel as other tools. An old file with teeth ground off is very commonly used as a lathe boring tool, others reappear as scrapers, and indeed old files may be seen doing many duties, and only distinguishable by the traces of teeth imperfectly removed.

If American steel will make good other tools, the file has fully equal rights to be made of the same quality.

Steamer "City of Paris."

The Inman liner City of Paris, which, it will be remembered, had an unfortunate breakdown on the Atlantic about a year ago, has had a thorough overhauling, and started on her trip to New York on the 13th inst., and is expected to arrive in this city before this issue is published. Although the accident to her machinery was an unfortunate one, it may be said that the trying ordeal of the ship at the time of the accident proved her to be one of the safest vessels in the mercantile marine. Even if some of the forward compartments of the ship had been filled with water, in addition to those already filled aft, she would still have had a fair amount of freeboard, and have been able to float, under the circumstances, the mean draught being only a few inches above her ordinary steaming trim. After passing safely through such an ordeal, the steamer will doubtless be as popular with the oceanic traveling public as heretofore, and as her consort, the City of New York, which continues to do so well.

From *Engineering*, London, we learn that the City of Paris has had new engines fitted on board, in lieu of those which broke down. The new engines are of exactly the same design as those originally fitted into the vessel. Indeed, many of the parts which, on being tested, were found to be thoroughly good, have again been used. Of the high-pressure engine, there were found suitable for use the piston, piston rod, connecting rod, eccentrics, eccentric rods, valve motion, air-pump lever, and air-pump complete, sole-plate and one of the supporting columns; and of the intermediate engine, the piston rod, connecting rod, eccentrics and valve motion, with one column. The low-pressure engine (which first gave way) is entirely new, but is of the same design, the old patterns having been utilized. The shafting is new from end to end. It is of the same diameter as formerly, the crank being 20¼ inches, with a hole 3½ inches diameter through the pins, which are 21 inches. The crank-shaft is made in three interchangeable pieces, which are 11 feet 6 inches long. The thrust-shaft is 16 feet 9 inches long, with a diameter of 19¼ inches, and 20½ inches between collars. There are three tunnel shafts, 22 feet 9 inches long and 19¼ inches in diame-

ter. The tube-shaft is 44 feet 6 inches long. All the shafts are made of Vickers steel. The shaft bearing in the after bracket has been lengthened 9 inches, making it 7 feet in length. A change has been made in the method of packing the lignum vitæ. There is a strip of brass between each of the lignum vitæ strips, and the wood is placed with the grain end on against the shaft. Indeed, the method of packing now employed is a recurrence to the former practice, Penn's original design being adopted. As an evidence that it must have been extraordinary circumstances which caused the collapse of the bearing of the starboard engine in the City of Paris last year, it is worth noting that, on the City of New York being docked the other day, and her bearings examined, it was found that neither the port nor starboard bearing had worn to any appreciable extent after eleven voyages. Besides, the bearing of the port shaft of the City of Paris showed no wear, and these three bearings were of the same construction as that which so completely failed after only one voyage.

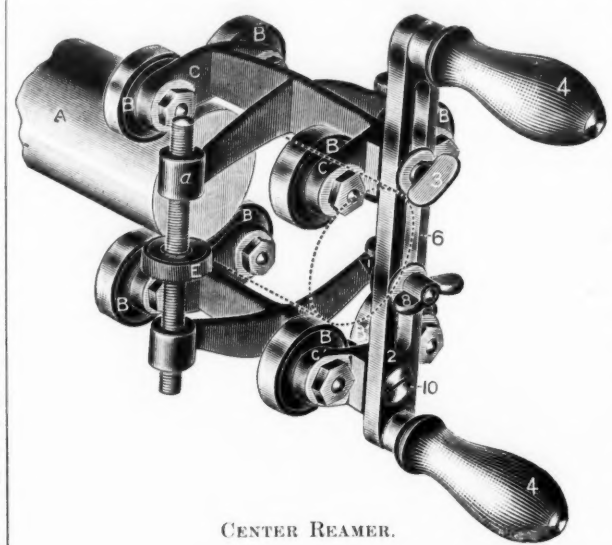
To enable the exact level of the shaft to be ascertained, the idea of the sounding lead has been borrowed. Through the counter of the ship, at a point immediately in line with the tube carrying the shaft, a hole has been bored, and lined with a brass tube. Through this tube there is passed an iron tube, made up of suitable lengths, screwed together as they pass through the hole, and these are dropped into a cup in the A frame, or propeller bracket. This cup allows direct communication with the shaft, and the rod is thus brought into contact with the top of the shaft. The length of the brass rod, which is rigid, indicates on a gauge whether the shaft has dropped even to the extent of the sixty-fourth part of an inch. Thus it is possible to ascertain if there is any wearing of a shaft while the vessel is at sea or in harbor. This arrangement, it may be added, is now at work on the City of New York.

There has been fitted to the main engines a device which controls the engines and stops them when they exceed a fixed number of revolutions. This controlling gear is connected with Brown's steam and hydraulic starting engine, and the similarity of the arrangement to the gas engine pendulum governor suggests the idea that it was from it that Mr. Betts Brown derived his inspiration. To the ordinary steam and hydraulic starting gear there is attached a small steam cylinder, which has always steam in it, being supplied from the same pipe as the starting engine. The steam is always on the top side of the piston, the idea being that whenever steam is on the starting engine the smaller cylinder should also be ready for operation.

A weighted bell crank, which can be adjusted to any number of revolutions, is kept reciprocating by a small lever attached to the air-pump lever. Should the revolutions of the main engine exceed any number previously determined upon—in the case of the City of Paris 120 revolutions—the inertia of the weight causes the upper arm of the bell crank to engage in a detent on the valve spindle of the small cylinder. On the ordinary starting gear there is a differential arrangement attached to the hydraulic cylinder. The lever admitting steam for moving the links also opens a port in the hydraulic cylinder admitting oil or water—whichever may be used—to either side of the piston. The differential gear, of course, closes the valve as fast as the lever opens it, and in any stoppage of the lever the links stop in a corresponding position. The controlling machine does not move the lever, but moves the fulcrum, on which the lever works, a sufficient distance to bring the valve into a position corresponding to the mid-position of the link. The latter being also in position, the differential gear closes the port in the hydraulic cylinder, and also the steam port, leaving the link amidship. It is said that during a trial this controlling gear did its work quickly and effectively.

An important alteration has been made in connection with the generation of steam. Formerly the nine boilers were worked under the closed stokehold system of forced draught, but during the time the vessel was laid aside, it was superseded by the Howden's system. The fire bars have been shortened 9 inches, which has reduced the grate area from 1,293 to 1,026 square feet. In this system of forced draught there are used twelve fans, by B. F. Sturtevant, of Boston, Mass. They are each 6 feet in diameter, and driven up to a maximum speed of 430 revolutions by a double engine by the same maker. The cylinders are 7 inches diameter; stroke, 5 inches.

Internally the vessel has been renovated and re-decorated, and bears all the appearance of a new steamer.



CENTER REAMER.

A Center Reamer.

With this we give an engraving of a new device, which is intended for the accomplishment of a job which every machinist knows is a somewhat difficult one with the usual facilities, *i. e.*, to ream or countersink centers in work that has been turned, and in which, for any reason, the original centers have been lost, either by cutting down the length of the work, by abuse, or uneven wear.

The device consists of a light frame arranged to carry eight rollers (designated by the letter *B*,) which can be adjusted to the work, so that all of them are in close contact with it, the frame being so arranged and tied by the double-ended adjusting screws *E*, that no springing or yielding is liable to take place.

At one end of this frame is the slotted bar (2), in which, by a thumb nut, the reamer (1) can be adjusted to or near the center. The device is then pushed onto the end of the shaft, as shown, and at the same time turned by the handles, with the result that the center is made absolutely true.

It will, of course, be understood that this is not intended as a regular centering device, but only to take the place of the tedious center scraping by hand, which is often necessary, and the method sometimes adopted of running the shaft in the lathe with the end to be centered in the back rest, while a tool is used for truing the center. It is also adapted to truing centers in cold-rolled shafting, or other work, which is round, but has been centered only approximately in a centering machine or by an attachment to cutting-off machine.

In most machine shops we should expect that this tool would be found useful. It is manufactured by the James Hunter Machine Co., North Adams, Mass.

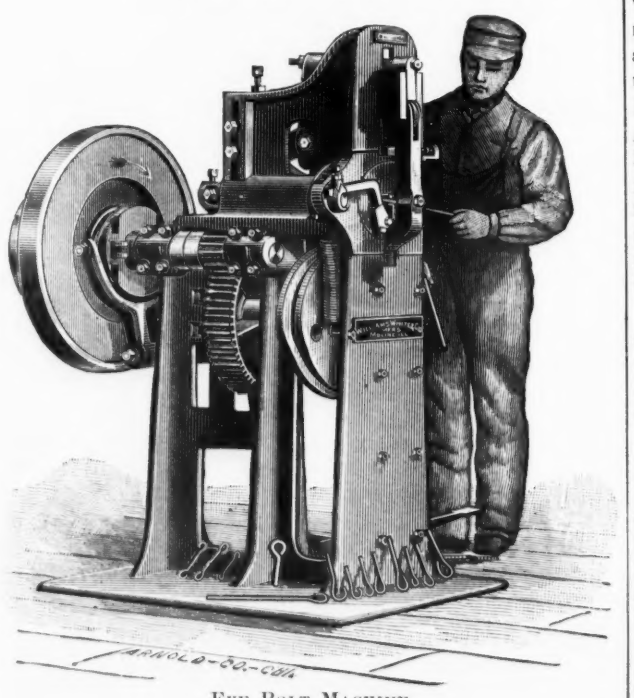
Eye Bolt Machine.

The accompanying engraving represents a machine recently brought out by Williams, White & Co., of Moline, Ill., for bending eye bolts of round iron from ¼″ to ⅝″ diameter.

The iron is introduced into the machine in the manner indicated by the engraving, when it is gripped by the dies, and from this point the action of the machine is entirely automatic. The end of the iron is shoved against a gauge, which, after it is gripped, is moved out of the way while the iron is bent around the mandrel to form the eye. This mandrel is then moved back by the continued action of the machine, letting the finished eye fall to the floor or a box.

Any diameter of eye may be made from ¼″ to 1″ diameter, this depending, of course, upon the diameter of the mandrel used. This mandrel has some tendency to groove where the iron passes round it, and it is therefore made sufficiently long to allow of its being dressed. It is readily detached or put in place.

The capacity of the machine depends rather upon the ability of the operator to feed it than upon anything else, but it is found that it is usually entirely practicable to run it at seventy-five revolutions per minute at first, making fifteen eyes complete per minute, and this rate can be exceeded after the operator becomes familiar with the machine. Power is taken by a friction clutch pulley, and there are two treadles, one to throw the clutch into engagement and the other to release it, so that the machine may run continuously, or it may be stopped as often as desired. The machine weighs 2,700 pounds, and occupies a floor space 36″x52″.



EYE BOLT MACHINE.

What Is a Milled Coin?

A good many years ago some of the coins produced in our mints had letters on their outer edges where what is now popularly denominated the "milling" is put on. This was called in the mints the "reading," and so the serrated edge, or, as the machinist would call it, the "knurling" on the edges of the silver and gold coins, is now called in the mints the "reading," simply because it takes the place of what at one time was literally the reading. In the mints all coins now made are recognized as milled coins, because in them the raised edge about the face of the coin is called the milling.

Indianapolis Shop Notes.

(Editorial Correspondence.)

THE DEAN BROS. STEAM PUMP WORKS.

Something like twenty years ago—more or less—this company moved from Rome, N. Y., to Indianapolis. This was something of a venture at the time; Indianapolis was then more of a western town than an important manufacturing center. But the company's business has prospered till now it is located in well-arranged shops, and is building a line of pumps that, in the modifications for different uses, embraces about five hundred varieties; embraces about everything from a small boiler feed pump to those suitable for water-works. The company has quite an eastern trade in independent pumps and condensers for steam yachts, and a large trade in vacuum pumps for various purposes.

The erecting shop is provided with a traveling crane, and chain falls cover the belted tools in the shops. A good deal of finishing of wearing parts is done by scraping; there are few shops where so common use is made of surface plates. In connection with the free use of such plates, the mechanical superintendent called the attention of the writer to the fact that skilled men were employed, and that they knew how to use such tools *all over*, thus keeping them in condition for a long time.

All pumps of every description are tested before leaving the works, a room being devoted to that purpose.

It is probable that additions will soon be built to the shops.

THE ATLAS ENGINE WORKS.

The Atlas Engine Works, situated in the northern part of Indianapolis, Ind., occupy ground space of 650x1,400 feet in the way of shop and yard room; nearly 1,000 men are employed, mainly in building steam engines and boilers. Formerly this firm was more especially known in connection with the Atlas Corliss engine, but at the present time none of these engines are built at the works, attention being given to the manufacture, in the engine line, of types brought out at the works up to 24 inches diameter of cylinder. These types embrace portable, semi-portable and fixed engines, both plain slide valve and automatic. In boilers, their manufacture ranges, in their regular lines, from 36 inches to 72 inches diameter.

Special tools are largely employed in the manufacture of both engines and boilers; it would be superfluous to say that parts were made in duplicate; no one manufactures in any other way in these times. Many of these special tools were made at the works. Planing is largely superseded by milling, a good deal of work being done by large heads, with inverted cutters. Of course a good many planers are still used, and it is a rarity to see one with less than two cutter heads. In the boiler department, special riveting machines, and machines for punching flue-heads and manholes, are in use.

This firm make what is known to the outside world as the Indianapolis sand molding machine, and excellent use is made of these machines in the foundry; in one instance one of them is used to make cylinders up to 18 inches diameter.

Pneumatic lifts are employed all over the works to an extent greater than we have seen elsewhere. These are remarkably efficient, being readily moved on overhead rails, and connection made with rubber pipes almost instantly. There is another feature of this pneumatic arrangement. These rubber pipes, with a good, smart air pressure always at hand, are mighty convenient for blowing the dust out of a mold or away from work in the machine shop.

Division of power is quite completely carried out, special engines being used for nearly every purpose. The largest engine we noticed in operation was a Corliss, quite moderate in size, but without releasing gear, the steam valves being controlled by a shaft governor.

Shipping is very readily done, tracks entering the works, and a yard engine being employed. This engine was built by the

company, and is of the type in which the reversing is done by moving the eccentrics across the shaft.

A new boiler house is being built, which will contain 1,500 horse-power of a boiler recently brought out, and many other improvements are being made, or are in contemplation. F. F. H.

Shop Habits.

BY FRED H. COLVIN.

There is nothing that clings to a man more persistently than habit. Take any shop in the country, and you will find that the different men are known by their habits, and very often nicknamed to coincide with some of their eccentricities. We find the men that always oil their countershafts every Monday morning, and the men that never oil them until they hear them "calling" with the familiar squeak that tells you oil is the medicine required. Regularity in this, as in other shop duties, is one of the best of habits, yet we find many who are good workmen that neglect this part of the work most shamefully, and let the counters go until they squeal to attract attention.

In some places where the lathes and machines are numerous enough to warrant it, they employ a man to attend the counters, thus relieving the lathe hand from all care in the matter, but with the habit once formed it is a part of the week's work to look to this the first thing on Monday morning.

Some oil regularly on Monday, regardless of circumstances; the belts may have been laced a little too tight, and in this case more oil is needed, yet hardly ever supplied until the inevitable squeak. However, it is a pretty good sign to see a man oil regularly, and it is apt to be an indication of regularity in all things; the man who only oils "when needed" is apt to forget until the shaft is cut or fire flies from the loose pulley. Some have an idea that when a machine is not in use it needs no oil, and so neglect it on that account, with the best intentions, too. In reality a counter needs more oil when not being used than when running all day; when running, the loose pulley is running free on the shaft, and only needs lubrication when the machine is stopped for a change of tools or work. When running idle the pulley is constantly in need of oil.

When you see a man oil his machinery with some regard to the work it has to do, you can generally depend on his being a careful and thoughtful man, and one that has a reason for doing things as he does, and does not go entirely by habit.

Then you see the man who invariably laces his belts too tight, and who wears out more belts and lacings than any man in the shop. If the belt he tackles is a grindstone belt, woe to the stone until the belt gets stretched to its normal length. The stone jumps every time the lacing comes around, and as the boxes are usually worn more or less (from lack of care) the stone rattles badly, and is not in the best condition for nice grinding.

Where practical to do so, it is best to have one man look after the belting of the shop, and while it is not always possible to extend this to the lathes and other machinery operated by individuals, it would be best if it were practical; belts are expensive appliances to be wasted and abused by any one that happens to be around.

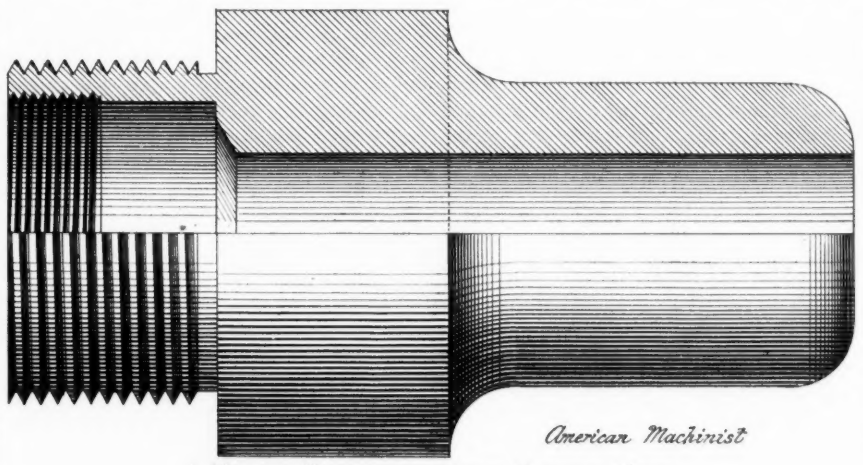
The man who is "just going to do it" is always to be found, and always tells you, in confidence, that he had thought of the plan (no matter what it is) long ago, and had never had time to make it or do it as the case may be. You can't mention any kind of work that he hasn't done, and they had made bigger and better ones in the place he used to work; everything from a set-screw to a locomotive he has built, and knows all about them, and doesn't hesitate to explain electricity to the uninitiated as fluently as though he knew what he was talking about.

About as comical a blunder of this kind as I know of was by a superintendent of a shop, who, seeing the drawing of a boiler check, mistook it for a whistle, and triumphantly informed the draftsman that they had made lots of larger whistles where he used to work. These men, although they are not aware of it, make fun for all hands, and so are not entirely useless in the world; just as the clown is a necessary feature of the circus, so this class of men make merriment for the rest of the men, and keep them in good humor.

Then we have the man who has "just forgotten," but always remembers when some one else finds the answer to the question; this is a harmless amusement for him, and the only fault is that he gets to believing it himself.

Putting tools down and forgetting their location is a common and very annoying habit; few are free from this habit in all respects, though there are different grades of delinquency; the extremists are a class that deserve pity, yet are so exasperating that they get very little. They invariably accuse some one of taking their tools, and not returning them, and then go storming up and down the shop until the missing article is found, probably near their own bench or machine. If this is the case they are sure some one has been hiding it, and has put it back to fool them, and they declare it to be a poorly run shop, etc., which is too often the case, so we cannot blame them entirely.

Worse than the man who forgets—in fact, one of the worst men there is—is the inveterate borrower, sometimes with and frequently without permission. This man is the one that all mechanics dread (except the other borrowers, they haven't anything to lend). He takes tools as though they were shop property, and very often forgets where they belong, but he has been written about until



A MODERN EXAMPLE OF SCREW MACHINE WORK.

it seems as though he ought to have hid himself, and drawn the hole in after him—but he hasn't.

Being on time would be a surprise to many who are otherwise very good men; that this is a habit without excuse (as an habitual occurrence) can be shown in many ways. A case comes to mind where the time was cut from ten to eight hours a day, but the "laters" could not get in at 8 o'clock any better than at 7, showing conclusively that it is habit, and not the time set for work.

Why is it some men get so much dirtier than others? This is a hard question to answer, and this, too, seems to a great extent to depend upon habit; one you will see with face, as well as hands, covered with dirt and grease, while his neighbor on the same kind of work will not be nearly so dirty. On some work it is impossible to keep clean and do justice to the work, but all, or nearly all, can clean up before going home from the shop. Very few shops have enough facilities for washing, but the most of them have enough, so that no one need go home without washing if he chooses. It takes a few minutes, to be sure, though not more than five or ten at the most, but it is more comfortable to go home looking and feeling clean, as well as pleasanter for the folks at home, even if you board. It pays to change your clothes, too—the outside ones—if it is so you can have a place for your others during working hours; you go home feeling more rested for the change, and no one doubts that it is more healthful. This is a habit that is catching by contact; I know of several cases where a new workman has come into a shop, and soon conformed to the custom of the rest, changed his clothes and went home looking and feeling much better.

In brass shops especially (though it is too prevalent everywhere) we see nearly all the men chewing tobacco, "to counteract the poison of the brass," they tell you, to prevent the dust going down their throats, or similar reasons; anything for an excuse.

A friend of mine was speaking of this the other day, and said that when he began to work at the business he was told he must chew anyhow, or it was sure death, but he remarked: "Many of those that advised me are dead now, and it hasn't killed me yet; guess I'm as healthy as though I had followed their advice."

There is a habit that is perpetuated by some of the older men, to a great extent, of teaching the boys that there is nothing of value to be found in the technical papers. This is especially the case when they get hold of a boy whose education is neglected, and who is the more willing to swallow all they tell him; they tell him he has learned enough, and will get along just as well as though he had been through college, and a lot more such nonsense that is not good food for a boy's brain to work on. Instead of trying to have him improve his knowledge, even if they cannot teach him, they fill him full of the ideas of conflict between theory and practice, and so warp his mind that he becomes like themselves, narrow in all views of life, moral as well as mechanical.

Instead of showing him how to figure out the gears for thread cutting, he is taught to go by the "gear plates," which are supposed to have been inspired by some one so long ago that they are right, and no one knows how they were obtained. Then they will tell how some college chap tried to reckon out the gear once, and made a man spoil a job, so "better stick by the plates." It disgusts any one, who tries to be progressive, to see such men, and, what is worse, to hear them spreading the same nonsense to the boys around them; they will die off in a few years, but the boys will live for some time, and will probably teach the same doctrine to all that come within reach.

Habit is responsible for dulling our minds in some ways also. When any one has been making a certain class of work for a long time, and doing it a prescribed way, he becomes dulled to the possibilities of any other and better way, and is not as liable to see chance of improvements as some one that has had training in another shop under different methods. Suggestions are often made by outsiders that are of great value to us, and we should not be offended to be asked why we do things thus and so, or resent the suggestions from an outside party. None of us know it all, though habitually doing work in a certain manner will lead any one to think there can be no new or better way than the one he has been using for years, but when we shut ourselves up in a sort of glass house we are losing the helps that come from those who see things through different glasses, and with different eyes. The best habit is that of trying to do what is right.

Captain McClennan gave some figures before the Boiler Makers Association at St. Louis that went to show that boiler explosions in Missouri were very materially decreasing in number. He attributes this quite largely to the fact that the matter has been so strongly agitated lately by various organizations.

A Modern Example of Screw Machine Work.

A short time ago in our editorial correspondence some of the things seen in the shops of the Hackney Hammer Co., at Cleveland, Ohio, were mentioned, and later we illustrated two different styles of the hammer.

It will be remembered that there are four air valves in each of these hammers (except the smaller sizes, which have three,) and as these are made of machinery steel, finished all over, the making of them becomes quite a respectable portion of the total work, and it becomes important to arrange for their economical production. This has been done by putting in one of the Bridgeport Machine Tool Works' (Bridgeport, Conn.,) largest turret head machines, upon which the body of the valve, shown full size by the accompanying engraving, is made. The engraving is an exact reproduction of a drawing made in this office, and is in every respect an accurate representation of a piece left with us, which is just as it came from the machine. The larger cylindrical portion is afterwards made hexagonal by milling. It is made from the bar, the hole which passes through it being drilled and reamed for the reception of a stem, which, by coming in contact with the movable wedge, opens the valve, the seat of which is shown just above the threaded portion. The threads must be accurately made to standard, and, in fact, the workmanship of the entire piece is very creditable. When the machine with the tools—which were made for making the piece—was set up in the shop where it was built to be tested, the piece was made, complete, in one hour, though as there was, as usual in such cases, more or less experimenting with the tools, that time is not considered as the best that is possible. It affords a good example of modern screw machine work of the heaviest character, such as a few years ago was not thought of in connection with such machines.

LETTERS FROM PRACTICAL MEN.

Fitting Up the Grindstone—Ball Bearings.

Editor American Machinist:

We all know the damage and danger which results from allowing a standing grindstone to remain partially immersed in water. Indeed, it is probable that nine-tenths of the structural trouble with grindstones arises from this cause, which is so productive of unevenness of texture and of wear.

Sheffield grinders, and all men who use big and heavy grinders, do not allow water to run upon the stone, as is done in a machine shop, but they run the lower edge of the stone in water, and preserve the water level at such a height that the stone just skims the surface, and does not pick up too much water. At the back of the pit or trough is inserted a large piece of timber. If this piece of timber be withdrawn, its bulk is such as to materially reduce the level of the water in the trough, and when the grinder ceases work at night or at dinner time, he simply removes the timber, and so leaves the stone dry.

I wrote recently we had got a new grindstone, and something was required to feed it with water. To this end, a trough of galvanized iron has been made and placed on the floor, so as to cover the lower edge of the stone, as in the figure. When partially filled with water, and placed so that one end rests upon a bit of timber arranged as a foot lever, the trough is easily lifted a little, so as to wet the grindstone, and this arrangement naturally suggests any amount of permanent devices having the same object. It is easy, too, to ensure that the trough shall never get too full, by the simple arrangement of an overflow pipe having a turned-down spout. The turned-down end can be gradually turned up as the stone wears, and so adjusted that the operator need but press

the foot lever as far as it will go to insure proper wetness, every time; of course, when far worn the trough would call for raising. but the same arrangement of lever would readily be adjusted to suit each change of height necessary.

I am glad to see some of your correspondents share my views that a college of workmanship with considerable fees can only mean a return to premium apprenticeship, which, in the end, will fail to produce any serious percentage of results. Many premium apprentices, no doubt, turn out well, but it is not because they paid a premium, but in spite of it.

I should like to ask some reader of the AMERICAN MACHINIST for his rule for the allowable and safe pressures on ball bearings; that is, the allowable weight per ball. Have recently made several bearings for heavy loads, and felt somewhat at a loss in proportioning the parts. Have used two different sizes of balls, $\frac{5}{16}''$, $\frac{3}{8}''$, and have some in hand now $\frac{3}{4}''$. Such as have, so far, been tried, have justified the design, but as yet the test has been too short.

In one instance the application has been to a position having much the same duties as the swivel of a heavy crane hook. Such hooks are frequently seen to work so stiffly, that, in twisting round the suspended load, the hook will not swivel, but instead, the suspending chain twists, or the ropes or chains of the blocks become twisted. With a ball bearing to the hook swivel all this is avoided, and, too, without any serious addition in appearance of clumsiness.

To facilitate repairs, I have arranged the ball paths in loose disks of steel, almost identical with those shown in the AMERICAN MACHINIST lately to hand, as applied to a drill press.

Hardened steel spheres are so very cheap, that the wonder is they are not more used in machine work. They are, of course, common enough in the bearings of cycles, which owe their popularity largely to their light running, which is solely possible by reason of these bearings. W. H. BOOTH.

Commutators—Hollow Shafts.

Editor American Machinist:

I have been very much interested in the articles on "Commutators" written by "practical men." I hope to see some more of them, especially as regards motor commutators; in regard to the dynamo, the brushes may be removed, and by running your machine at a moderate speed you can get in some work with a file or the grooved block described by A. A. Cross, or both. But with the motor it is different; you can't take off your brushes and run your machine with electricity. You may be able to put a man onto a crank somewhere in the shop, and then again, if there are two or three lengths of line shaft to run, you may have more than one crank to contend with, especially if the weather should be warm.

I wonder if any of your readers have ever tried a fly-wheel on a motor. I am running a small machine shop with a two horse-power motor; amongst other things I have a 24″x24″x6′ planer which I run a good deal on short work; when this planer reverses it causes a decided yank to the belt, the effect being noticeable at the motor to a slight extent. Would not a fly-wheel help the matter? I intend trying it.

A short time ago I made two commutators of tempered copper; it cut free and nice; the chip rolled off just as it would off soft machinery steel, but it was very much softer, and consequently could be run faster; it did not tear like ordinary copper does in the lathe.

In Question 218, in your issue of May 14th, J. W. C. asks for some information about hollow steel propeller shafts for ocean steamers. Three years ago last fall I saw a forging for one in an exhibition at Manchester, Eng., made by Sir Wm. Armstrong, on which there had been no machine work done; it was 18″ outside diameter, 15″ inside, and 25 or 30 feet long; it looked more like a pipe than a shaft. CHAS. A. TRASK.

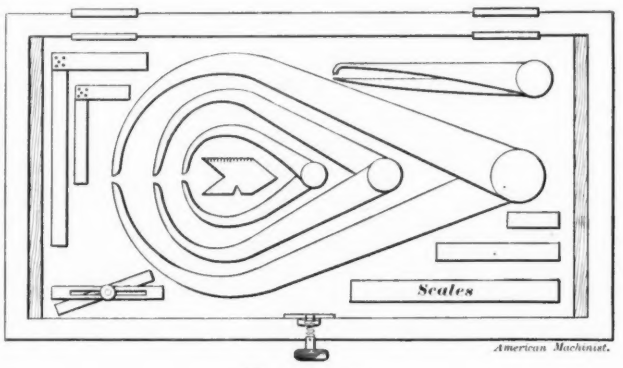
The Tool Chest.

Editor American Machinist:

Please find enclosed a rough sketch of a cover containing a false cover for tool chests. This, I think, will be of interest to our friends who are about to build a chest. The false cover is to be made out of pine or any soft wood, and carved so that the tools will fit snug in same.

When a tool is wanted out of the false cover, all you have to do is to pull the button; it will do the rest if you open the lid.

The bottom of the first cover may be lined with felt, which would tend to keep the tools in place better if they fit too loosely. ARTHUR MUNCH.



TOOL CHEST.

Ancient versus Modern Apprentices.

Editor American Machinist:

I have been reading letters from Jarno and others, in which they describe customs and methods which are so radically different from those in vogue in our shop, that the mere mention of them causes a smile, however, more of regret and envy than of amusement.

Ours is a large shop, having in its different departments nearly 200 apprentices, and it would seem that some special care would be taken to instruct them. But such is not the case. The apprentice is simply a laborer who works for almost nothing, and is a very important factor in the profit making of the shop. When he enters, he is put under a job boss, who is also called "the old man," but who is so different from "the old man" of Mr. Rogers' acquaintance, that comparison cannot be made, only contrast is admissible.

In this room there are only three kinds of machines which apprentices are allowed to operate—a punch, a milling machine, and about 40 lathes, without back gears or thread attachment, and fortunate indeed is the cub who gets a chance at all three. I have known boys to spend a whole year on one of these lathes, on exactly the same work, too.

In this room an apprentice is expected to spend his first year, and no power in heaven or earth can remove him before that time. When I say "stay," I mean it in its literal sense, for the superintendent and his assistant go about like roaring lions, and woe unto the unlucky cub who is found out of his room without a good cause.

The shop is run on the duplicate part system; the planing for the most part is done in one room, the lathe work in another, etc., so it is practically impossible to learn much without going around some.

This state of affairs is particularly discouraging to a young man with visions of the evolution of a cub into a superintendent or foreman before his eyes. But he soon awakes to the sad reality that there are many illusions in life, and that things are not what they seem.

Yet, strange to say, the shop has such an extended reputation, and such is the well-known ability of its officials, that this state of affairs is not believed in the shops of the surrounding cities, and it is hard for an apprentice, who voluntarily leaves, to get employment.

Not having an opportunity to look around much, I would like to know if other shops are run on the same plan, and if so, may modern progress and intelligence hasten the day when history will again repeat itself, and the old-time way again appear.

A MODERN APPRENTICE.

That Question in Ethics.

Editor American Machinist:

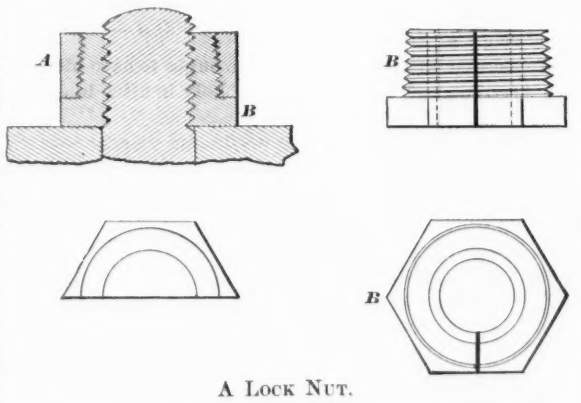
I read with a great deal of interest "Technic's" "Question in Shop Ethics," and have read with increased interest the answers, none of them agreeing except as to the extortional feature of the note. From the damages done I should judge the position that the young man holds to be a responsible one. If his wages are below the standard that such a position demands, any charge for damages would be extortion, as a reduced rate of wages insures the employer against accidental neglect. If the wages received by the employe correspond with the responsibility assumed, then the employe should repair damages. This, I think, is just and fair to both sides. Now the question arises, What is to be done in a case where the wages paid compare with the skill? This is a little too hard for me. It is impossible for any one to say whether the note is usury or not, without knowing the terms involved.

Let me ask a question: Why didn't the young man have the damages repaired, if he thought that damages were due?—then there would have been no question as to the value of the job. No one, it seems, ordered a stop-cock put in there with a vent hole in it, and I think that it would have been a mere accident if the young man had discovered the vent hole without testing his job. If the experience of all mechanics were told very few of them would be grateful to their employers for doing such beneficent acts as this young man's employer did, and I am afraid that this young man will advance to a ripe old age before he can fully appreciate the benevolence brought forth in this experience. OBSERVER.

A Lock Nut.

Editor American Machinist:

I enclose a sketch of a lock nut which is different from any I have ever seen, and though I am not so situated as to be able to try it, and so cannot answer for its working, I can see no reason why it should not work satisfactorily. It is composed of two pieces, *A*, and *B*. *B* is the nut proper which is split at one side as shown, and has screwed onto it the taper nut *A*, which binds it firmly to the screw. H. C. S.



A LOCK NUT.

From the Foundry.

Editor American Machinist:

The members and others interested in our Foundry Apprentices Association here have been very much interested in the articles which have been appearing in your paper relating to their business, especially, perhaps, in the record of the advancement made in green sand molding, and in such articles as "A Word in Behalf of Molders' Apprentices," issue of April 23. I can assure you that the time spent in writing such articles is well spent, a fact of which you would readily be convinced if you could be present at one of our meetings and witness the interest taken in discussions of these matters. The first thing the boys do when the paper comes is to see whether or not there is anything in it about the foundry, and if there is, we make a lesson of it for the evening. And often the evening is too short, and it is nearly or quite twelve o'clock before we disperse. It makes them feel proud to read of things pertaining to their trade, and to find that others are interested in advancing it, and I know, from what I can see of their work in the shop, that these articles are a direct benefit to them.

Green sand molding is progressing as well as other branches of the art. I remember about thirty years ago a small cylinder was to be made in the shop where I was working, and the foreman was the only man in the shop who could make it. There was an old iron flask there for that work, and to hunt up all the rigging and get ready took longer than to mold it. It had to be molded in dry sand, and as there was no oven large enough to dry it, it had to be dried on the floor by covering it with sheet-iron and burning charcoal. It took a week to mold, dry, and cast this cylinder, whereas nowadays cylinders twice as large and much more complicated in form have to be cast the second day after the order is received; and it is done more easily now than then. The idea prevailed among molders in those days that such a job could not be good unless it was cast in dry sand and a week or two spent in doing it; but that time is past, and almost forgotten, and it is well.

I do not put much faith in skin-dried molds. I once worked in a shop where everything of any size had to be skin-dried, especially the top part. It was the custom to get some shavings, light them and hoist the top part of the mold over them to skin-dry it. One day we were late, and there was no time to burn shavings. Yet, the casting came out as well as the day before when there had been plenty of shavings burned. So we stopped it entirely, at the saving of a great deal of dirt and time, and with just as good work.

I believe in green sand molds, or, all dry sand—dried in the core oven if there is one large enough. A green sand mold, properly rammed, vented, and blacked with silver lead, using a camel's-hair brush, will stand as much as a skin-dried mold, with all the clay wash and molasses water, as there is generally one part burned and other parts not dried at all, and if the mold stands for some time before casting, the dampness from other parts of the mold penetrates the parts that have been skin-dried.

There is nothing better than to finish and apply the blacking with a brush. The blacking hangs better on the mold, and the iron runs better over the mold than if slicked with a trowel, and produces better and cleaner castings. The camel's-hair brush can be applied to most any mold, and tool marks will not then show when the casting makes its appearance. It is surprising what can be done with the brush, with proper care and management.

Green sand molding and its advancement is an American idea. The old country molder is for dry sand or loam, but the American molder for green sand.

VALENTINE GEISELHART.

What is a Journeyman?

Editor American Machinist:

As Mr. James Francis has taken my name (not in vain, perhaps,) apropos an illustration, I feel called upon to say something more upon the subject, which, I trust, will be followed up after a time by Professor Sweet, and that is as to what constitutes a journeyman.

Now as I understand language, the word would signify a man who travels, but Webster says: "A mechanic hired to work for another." Now, Mr. Editor, isn't journeyman an ambiguous term? We occasionally have a tramp machinist. No doubt in the "good old times" that was what was believed to be the proper designation for those who had served a certain time under the in-

struction of a master who was skilled in the art; but at the present day when even the master is not (the chances are) a mechanic, had we not better relegate the term to "innocuous desuetude"? and either call him a man, or—if competent—a professor of machinistry.

The term machinist is falling into bad repute, because of the fact that not one in thirty-nine who work in machine shops building machinery can honestly call themselves masters of the trade—as it formerly was. They are specialists, with nothing better than the generic name to describe them by.

What has become of the mechanics who were masters in the past decade? There used to be a lot of millwrights; a goodly portion of them have gone to make that grand (although young) organization—the American Society of Mechanical Engineers. They are now, in the minds of some, translated into another sphere as it were. There are a great many of these who do not renounce their allegiance to the "trade," but still look back (and don't have to look so far back, either) to the time when they were not even good machinists, and wish they had life to live over again. I know of some who would go and make an iron-bound contract with some shopmaster, and it would be a mutual one, too, that the aforesaid duly apprenticed party should be hereby bounden to do his utmost in return for a good and valuable consideration, to wit, viz., to be shown the methods of the shop or works of the hereinbefore mentioned shopmaster for so long a time as was necessary to enable him to go into A., B. or C.'s shop, and, without extortion, receive proper wages.

Now just a few words regarding the "born mechanic." There may be such a thing; I don't know, but I think that if a man is born to DO he can *do*. Let us take some of those who were born to be mechanics (?) If any one of them had not had the privileges of the mechanical training, I have not the slightest doubt but that he could have put his vital forces at work in any line with which he might have came in contact. Early associates and locality have much to do in shaping the career of the young. A child brought up in a place like Hartford or Worcester has a much better start in machinistry than one brought up in the pork packing district of Cincinnati or Chicago, and I think that you will find that the percentage of machinists largely comes from down east. I use the term machinist now in its broad sense, and I do not wish to throw discredit upon any section, but as an illustration in furtherance of my argument. If there is such a thing as a born anything, I believe that he can adapt himself to anything, provided he puts himself into it. We can look to nature for an exemplification of this—those animals who change their color to correspond to the color of their surroundings, also others whose shape changes to fit the habitation which they have taken without scruple from some weaker species.

J. A. GILKERSON.

A Phenomenon.

Editor American Machinist:

You will please find enclosed a small screw-driver, such as is used by jewelers, having a loose head, on which the finger rests when turning in screws. (See sketch.)

What I wish particularly to call attention to, is the fact that when the point of this screw-driver is held vertically on the top of a common grindstone, or other wheel, having a rough surface, the loose top will revolve rapidly in one direction. The direction of revolution does not depend upon which way the wheel is going; for instance, if the wheel is going to the left, and the top of the screw-driver is going in the same direction, it cannot be made to run in an opposite course, by reversing the motion of the wheel, or by inclining the screw-driver at different angles, or even stopping the top, and spinning it the other way with the fingers. If the blade of the tool is held parallel with the direction of motion of the surface of the wheel, the top will revolve to the left, and if the blade is turned at right angles the motion of the top will be reversed. I should like to have this phenomenon explained, if possible, as well as, why does the tang of most files heat up first, when the other end is held hard against a dry grindstone?

I had my attention called to the stopping of one of the New York elevated trains recently. Under the hands of the locomotive engineer the stopping of this train was made most agreeably without the little back jerk (not always little) we are generally prepared for, on most trains. All he did, was simply to release his brakes, quickly, just a few seconds before the train came to a full stop. Since then I have been watching the actions of brakes, and I find we have a pretty powerful motor under each end of an ordinary passenger car.

It would seem that this difficulty might be overcome by hanging the brake beams in some way, so that the friction of the shoe would not affect the springs every time the brake is applied, and thus cause a reverse motion of the wheels to enable the springs to get back to their normal position.

W. S. HOWARD.

[Mr. Howard encloses a sketch showing how the frame of the truck is forced down at one end, and up at the other by the action of the brakes, which, when they are released at stopping, produces the disagreeable jerk referred to. It is a matter that is well understood among the better posted railroad men, however, and a skillful engineer so times his release of the brakes as to just allow the frames of the trucks to assume their normal position at the instant of stopping, just as the engineer referred to by Mr. Howard did. The majority of them, however, pay little or no attention to this, and hence the jerking. The good condition of the brake mechanism is, however, important in the matter, since jerking cannot well be avoided by the most skillful and careful engineer, unless everything pertaining to the brakes is in first-class order.—ED.]

Teaching a Trade.

Editor American Machinist:

No subject can be more interesting to the mechanic than the one raised by Professor Sweet, in his recent communication on an Industrial University, and that impels me to take a hand in the discussion. It seems difficult for some to let go of the idea that there must be a certain amount of book teaching, drawing and lecturing, with any proposed system of teaching a trade, and yet that is not by any means an essential part of the process. If a boy have a public school education, such as he can get by attending regularly until 16 years of age, he will have an education quite sufficient to learn a trade. The numerous applicants for an opportunity to learn the machinist trade did not expect or want to get an education in drawing and higher branches of the art; they only wanted to learn the "how to do" part of it; yet the professor is outlining a plan which requires a lot of teaching and lecturing.

I have known several young men who learned the machinist trade in three years in a good machine shop, who never received during that time 15 minutes' instructions from the foreman as to how to do their work, and yet at the expiration of the time, they were competent to go into another shop, and get good wages. I am sure that I could have learned more of the trade in two years, under a proper course of instructions than I could possibly have learned in three years in the manner in which I was obliged to learn it. I can look back over the time, and see where I was painfully and slowly groping my way towards the knowledge I needed, which I could have learned in half the time, if some one had been by with timely suggestions and cautions, and which would also have saved my employers considerable in the way of broken tools and spoiled work. This was the common experience of all the apprentices in that shop, where I estimate that near 100 boys have served three years' apprentice terms. Not more than one-fourth of these were so slow at learning as not to be fairly proficient at the close of their term; a few afterwards became good machinists.

Judging from this and other observations, I would say that two years would be ample time in which to teach the trade, if done as it should be. To make the system as efficient as possible, there ought to be about one machinst to each ten apprentices, and he should be a thorough machinist, and have in addition the ability to explain how to do the work; and such men will demand good wages, but their presence will keep the standard of workmanship high enough, so the product can hold a place in the market. For the two-year term a tuition fee would be required, but for those who could not pay that, a longer term might be arranged, in which the latter part would be spent working on piece-work at a commercial rate, until the institution was repaid, and in this way the most proficient would get through first. The objections raised to the piece-work system, by mechanics, are all due to the greed of proprietors who operate it; it is entirely successful where there is a proper way of regulating the rates, as is the case in the iron-making industries. In a trade school the rates could readily be arranged so as to be to the best interests of all concerned.

There is one question in connection with this subject that has been touched by some of your contributors, which ought to be more fully discussed, because it is of great importance to the whole scheme: Is there really a demand for better machinists and molders than we now have? If so, why do proprietors of shops refuse to teach trades, since it is admitted that a profit can be made from properly managed apprentices? If more can be made by employing boys without teaching them a trade, it must be evident there is no demand for any better class of labor by such proprietors, and it would, of course, be useless to teach boys a trade with the expectation that they could take the places of those without trades.

I have no means of knowing to what extent trades unions limit the number of machinists' apprentices taken, but so far as I do know, the limit by the shop proprietors is the only one operative. I wish some of your correspondents from other parts of the country would place before your readers further information on this point. It is an open question whether there are now enough machinists' apprentices being taken to supply the future demands; I think there are not, and that there have not been for several years, for I have seen in the last few years many machinists put at work they were not competent to do, because there was no better talent available at the time. In some of these cases, however, the proprietors would not pay enough to get competent men, and yet would complain greatly about the ignorance or stupidity of their employes. But I have known several instances where the proprietors were paying the highest average rates, and yet could not get competent machinists to do their work. This fact shows that there is a moderate demand for a better class of machinists, if they are willing to accept the wages offered.

I think one of the chief reasons that more apprentices are not taken, is that shop proprietors have neglected the matter, because they did not recognize their duty to the trade and the business as they should. Some proprietors have fully realized the need, and have met it by taking all the apprentices they could well make use of, and they are now fortunate in the possession of all the skilled mechanics they need, besides having furnished many to other shops.

One of your contributors fears that the product of the trade schools would cheapen that class of labor, and no doubt it would have a tendency that way, but the final effect would be to replace incompetent workmen by better ones, and the rate of wages would not be permanently changed from that cause, for the reason that this class of trades are not so attractive as to cause a large number to learn them.

I think Professor Sweet has a very unusual number of applicants to learn trades; I doubt if there are a dozen other shops in the country of the size of his that can record such a large number; I think it is largely due to the wide personal reputation of Professor Sweet.

As to the chance the poor boy will have, who cannot afford to learn a trade at the school, there will always be shops which will take apprentices on the usual plan, because properly managed apprentices will pay as well as ever, regardless of the schools. Any kind of a properly conceived and conducted educational institution will always be of benefit to humanity, but the poor young man of determination and ability will continue to come to the front without their aid, as the Watts and Stephensons have heretofore done. Any one who hopes that a better class of mechanics can be turned out by a trade school than can be produced by the apprentice system, will certainly be disappointed; for, as Professor Sweet says, "trades can never be acquired in any possible way, except by years of direct and prolonged application in the use of tools, directed by constant and inquisitive thought," and the most that can be expected of a school would be to provide means of getting a trade in the shortest possible time, with or without tuition fees, as the case may be. The apprentice system produces good enough mechanics, but apparently not enough of them, and the schools would provide the means of supplying whatever demand there may be for additional mechanics, and this certainly would be a benefit to all concerned.

BELL CRANK.

The Term "Monkey Wrench."

In our issue of May 7 we asked for information regarding the origin of the name "monkey" wrench. We received quite a number of replies, and curiously enough they all referred to an item that has been going the rounds of the newspapers, according to which the name originated in the circumstance that Mr. Chas. Monckey, of Kings County, N. Y., invented it, and sold the patent for $2,000 to the Coes Wrench Co., of Worcester, Mass.

We thereupon addressed a letter to the company asking them for confirmation of the story, or for the facts of the case so far as known to them. We have received the following reply:

Editor American Machinist:

DEAR SIR:—Yours of 16th inst. received. We have been told that the term "monkey wrench" came from the connection of a man by the name of Monckey with the tool. One story is that Mr. Monckey invented an adjustable wrench; and he may have been an early inventor—we do not know. Another story is that a man by the name of Monckey worked by the piece for a manufacturer who made wrenches and other tools. The man Monckey had the wrenches to make by the job, or piece, and the shop hands called the wrenches "Monckey's wrenches," and in time this was changed to "monkey wrenches," and we are inclined to think this last story is the correct one.

The Coes wrench, now so well-known to the trade, is the invention of Loring Coes, and was patented by him in April, 1841.

Mr. Monckey did not sell any patent to this company or any of its predecessors.

Yours truly,
COES WRENCH CO., J. H. C.

A Southern Exhibition.

We are in receipt of a communication from Mr. John T. Patrick, who is the commissioner in charge of the permanent Exhibition of Southern Products which is to be opened at Raleigh, N. C. Northern manufacturers are especially and most cordially invited to make exhibits. Mr. Patrick, who may be addressed at Raleigh, will be glad to give full particulars.

An example of the valuable engineering knowledge disseminated by the daily newspapers is seen in an item which is now making the rounds of the press, in which it is gravely announced that "after many experiments" at a prominent wire manufacturing establishment, a "process has been discovered whereby steel wire can be made that will stand a strain and tension *equal to copper wire*, and is cheaper."

AMERICAN MACHINIST

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J. G. A. MEYER, } Associates.
FRED J. MILLER, }

Special Announcements.

☞ Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.

☞ Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.

☞ We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.

☞ We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.

☞ Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.

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The Nature of the Lesson.

Some time ago we warned our readers to be very cautious about investing in the various "orders" which hold out glittering promises of phenomenal returns for small investments of money. Since that time the inevitable end of many of these schemes has come, and the utter absurdity of the claims and promises made by them is now, we hope, pretty generally understood.

It is easy to say, as many of the newspapers are now saying, that the experience of working people with these orders ought to teach them a useful lesson, *i. e.*, not to meddle with new financial schemes, which, from the nature of the case, they cannot be expected to know anything about.

But it may be as well to point out that working people are by no means the only ones who need to learn such lessons, and all such experiences should teach not only workingmen, but all other men, that new schemes of any kind, which promise to give returns much above the usual returns from investments, should be scrutinized very carefully before going into them, and the investigation should be made by some one who, by previous training and experience, is qualified to judge of their merits.

But [this advice is as much needed by capitalists as by workingmen. There are plenty of men familiar with business and financial affairs, who are to-day commenting upon what they call the stupidity of the working people in going into these orders, who are destined to be relieved of a good part of their money by means of plausible schemes in mechanics or engineering—schemes which some of these same workingmen would instantly recognize the absurdity of.

The lesson to be learned from the collapse of these orders is a broad and comprehensive one, and, stated in general terms, it means: Do not expect to get something for nothing, except by gift or by robbery.

And it is a lesson which needs equally to be learned by the city workman who invests in "short term order" shares, the countryman who invests in shoddy clothing at a traveling "bankrupt sale," and the capitalist, who, because he has made money in the manufacture of cotton cloth, or shoes, thinks he is competent to decide upon the merits of any new mechanical device which may be presented to him, and who invests in them, without a thought of taking advice from those who are competent to give it.

A Word of Caution About Export Trade.

The increased interest which is being taken in export trade is giving, it seems, a chance for new operations by the class of people who are always on the lookout for opportunities to make money without intending to give a fair equivalent for it. In this respect the development of export trade does not, of course, differ from the development of almost anything else, and at all times it behooves those who are asked to part with their money or goods, to be at least reasonably sure that they are dealing with men who intend to do, and are able to do, just what they promise.

Manufacturers are being induced to sign advertising contracts with papers claiming to make a specialty of advancing the interests of American manufacturers and merchants in foreign countries. In some cases these papers are little else than price lists of large dealers, and manufacturers are asked to pay for advertising space in them, at the same time being given to understand that a refusal to do so will cause the firm publishing the price list to handle the goods of some rival manufacturer. The distinction between this operation and ordinary plain blackmailing is not very clear.

A manufacturer of carriages, who has had some experience in advertising in various "export editions" of one thing or another, says that he noticed that practically the only inquiries received by him in answer to the advertisements came in just previous to the time for renewal of the contracts, and as nothing came of these, his conclusion was that they had some connection with the subsequent efforts of the persuasive solicitor.

But the worst instance, perhaps, is to be found in the case of some who offer to take as payment for the advertisement, part cash and the balance in the regular goods of the manufacturer, which he is told are to be taken to the foreign field at which the "edition" is specially aimed, and disposed of, since the publishers have already a steady demand in that country for such goods. This seems to be a very enticing offer, but in some instances at least, when such an offer has been accepted, the goods have been brought immediately to New York City and sold to dealers far below the manufacturers' lowest wholesale quotations, and it has thus occurred in some instances that a jobber in this city has been able to sell certain goods at a profit, below what the manufacturer could produce them for. In such a case, of course, no effort whatever is made to dispose of the goods in any foreign country. The cash paid by the manufacturer is far more than the value of the advertisement; if, indeed, it possess any value whatever; and the money received for the goods is so much more clear gain, while the goods themselves become a disturbing element prejudicial to the manufacturer, who would have been decidedly better off if he had thrown them into the sea.

Advertising with special reference to foreign trade may, of course, be done in such a way as to bring returns, but, generally speaking, it should be through the medium of well-established journals circulating upon their merits in the countries it is desired to reach. At any rate, the experience related above should prevent any of our readers from going into such schemes without first assuring themselves that there is at least an intention to do what is promised.

Machine Writing.

Writing by machinery has now come to be almost the universal practice in the business world, and the click of the typewriter is heard in nearly every business office. A different class of work, however, is that of authors and others who themselves operate the machine to put their thoughts upon paper, and it has been thought by many that it would not be adapted to this work, for the reason that the attention necessary to be given to the machine would interfere with the uninterrupted thinking necessary to do such work. Experience is proving, however, that this difficulty exists only in the imagination, and some of the best writers of the day, including Mr. Howells, Frank Stockton, Robert J. Burdette and Margaret Deland, are said to regularly write their copy on the machine, some of them declaring that the click of the keys seems to make their thoughts flow more freely. And after all there should be little surprise at this. The key-board of a typewriter soon becomes as familiar to the operator as the keys of a piano to the musician, and after that the making of letters by striking the keys is really a more simple matter than by making them with the pen, for with the machine precisely the same motion is required for each letter, and they are made without the necessity for thinking of the means by which they are made. A number of our correspondents send in typewritten manuscripts and a constantly increasing proportion of the matter appearing in this paper is written by machinery.

Arbitration has been looked forward to by a good many people in this country as the means by which labor troubles could, to a great extent at least, be settled. And it has worked satisfactorily in most instances when fairly tried; as a recent example, in the strike of the street railroad employes in Detroit. Arbitration is supposed to be the leaving of points in dispute, including an increase or decrease in wages, to disinterested parties. The worst trouble in employing arbitration so far, has been the assumption on one side or the other that that side was right on certain points, and hence these points could not be considered by the arbitrators. This appears an extremely childlike dodging of the question, but there is more of craftiness than childishness in it. When one side is palpably right on any points in dispute, there will be no question about intelligent arbitrators seeing it without serious delay; this is one of the strong arguments in favor of arbitration. When either party, professing a willingness to arbitrate differences, insists that there are points of difference in which it is so plainly right that it will not submit them to arbitration, it is entirely safe to conclude that this party does not propose to settle by arbitration, and is employing subterfuge.

Literary Notes.

A new journal, called the *Engineering Review*, has made its appearance in London, the first number having just come to hand here. It is a monthly, and is devoted to matters pertaining to civil, mechanical and electrical engineering. It is announced that it is the intention to make the new journal a "complete and dependable reference book for civil, mechanical, and electrical engineers." This, of course, can only be done by providing a complete record of current progress in these branches of engineering—an undertaking of considerable magnitude. However, the first number of the new journal is an interesting and creditable one, and seems likely to find favor with those for whom it is intended. It is edited and published by Andrée & Walker, St. Paul's Chambers, 19 Ludgate Hill, London, E. C.

Mr. George H. Howard, of Washington, D. C., has published, in pamphlet form, a story entitled, "Things Seen and Heard by Ebenezer Bassett, Inventor, During the Celebration of the Beginning of the Third Century of the American Patent System, at Washington, D. C. 1991." It is prophetic of the manner in which the Patent Office will be carried on in 1991, written in a humorous vein, and contains several clever hits at the present methods. Electricity, of course, plays an important part, as it does in most prophetic writing of the day.

PRACTICAL BLACKSMITHING. A collection of articles contributed at different times by skilled workmen to the columns of the *Blacksmith and Wheelwright*, and covering nearly the whole range of blacksmithing, from the simplest job of work to some of the most complex forgings. Compiled and edited by M. T. Richardson, Editor of the *Blacksmith and Wheelwright*. Volume IV.

This volume is the fourth of a series devoted to blacksmithing; and, like its companion volumes, contains much valuable information, contributed by practical men from all quarters of the country. It cannot fail to be of great assistance to blacksmiths, and to all others seeking information on this class of work. In this volume is continued the interesting topic of job work which was begun in Vol. III. Considerable space is also devoted to cutting, bending, welding, and setting tires, setting axles, resetting old springs, welding and tempering springs, making bob sleds, tempering knives, mill picks, making and tempering dies, taps, drills and other tools, proportions of bolts and nuts, forms of heads, etc., and the manner of case-hardening. The last chapter is devoted to tables of iron and steel, including the sizes of iron and different forms used by carriage, wagon and sleigh makers. The volume is illustrated, and printed with clear, large type, on good paper, and contains over 250 pages. This volume and the three preceding ones make up a library which every member of the craft should possess. They are published by M. T. Richardson, Publisher, New York. The price of Vol. IV is $1.00.

We trust we may be allowed to take this method of thanking our many friends who have taken occasion to congratulate us on our growth of circulation recently mentioned, and to express their kind approval of the course pursued by this paper, and high appreciation of its value to them. It is not our practice to publish such commendations, but they are nevertheless fully appreciated, and we thank our friends for them.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(234) A. P. W., Albany, N. Y., writes: Please give the indicated horse-power of an engine with cylinder 15 inches diameter, 3 feet stroke; number of revolutions, 45 per minute; boiler pressure, 80 pounds. *A.*—We should rate it at 57 I. H. P.

(235) I. K. W., ———, asks: Is there an absolute gauge for all machine screws and taps that are in the market, and if so, what are the decimal sizes, and does such a gauge apply to wood screws? *A.*—There is such a gauge, and it applies to wood screws. You will find full information regarding it in the answer to Question 45, issue of Jan. 22, '91, and in an article in issue of Aug. 18, 1888, the decimal sizes being given in tables published in the last named number.

(236) M. E. W., ———, asks: Can Mushett's steel be annealed so that it can be worked like common steel? If it can, how? *A.*—It is claimed that this has been done, but we do not know the process, and doubt if it is a practicable one. If steel is to be worked cold, we should choose some other kind. 2. What is the highest percentage of carbon that can be given to steel? *A.*—We do not know just what the highest possible percentage is for steel, but three per cent. is about as high as it goes in practice.

(237) G. A. S., Brooklyn, N. Y., writes: Will I have to get a license to run a steam engine and boiler of two horse-power in a steam launch for pleasure purposes only? If so, would one be granted to me provided I can answer all questions? I am only nineteen years of years. I built the engine myself and am fully competent to run a boiler. *A.*—You will need a special license; your examination will not be very severe, and we see no reason for a failure in obtaining a license.

(238) G. H. W., Pittsburgh, Pa., writes: I would like to know if there is any machinery for manufacturing clay tobacco pipes. If so, please let me know if they are patented. *A.*—We do not know of any machinery at present in use for the purpose. Clay pipes are made by hand with an iron mold and a steel wire for forming the tube of the stem. Pipe molding is a very simple operation in pottery, and the work is performed with great celerity. A number of machines have been devised for automatic pipe molding; but the manual operations are so rapid and inexpensive that there is little margin for saving by the substitution of machinery.

(239) A. W., Middletown, Conn., writes: I have a very large number of sheet-steel springs to harden, and it is very essential that these springs shall not warp even in the slightest degree, it being necessary to have absolute uniformity in their shape and position. I have tried a number of ways to get good results, but have failed to find one that is entirely satisfactory. Can you or your readers give me the benefit of experience in this line? The springs are made from S. & C. Wardlow's best spring steel. *A.*—Springs of this kind are sometimes hardened by placing them—after they are heated—between two cold dies. But probably some of our readers will know of a better way.

(240) R. E. H., ———, writes: Please give me a good method for approximating the form of gear teeth with compasses. *A.*—We cannot do this without a drawing, which it seems unnecessary for us to publish, since nearly every engineer's pocket-book contains such directions, and a reference to Mr. Grant's articles, which were concluded in our columns with the last number of the last volume, will show you how it may be done. 2. What is the Franklin Institute of Philadelphia, and where can its journal be obtained? *A.*—The Franklin Institute is simply an association of engineers and others interested in the advancement of the useful arts and sciences. It holds regular meetings at which papers are read and discussed. It also bestows medals, etc., for useful inventions submitted to its committees for investigation. Its journal may be obtained by addressing the Franklin Institute, Philadelphia, Pa.

(241) G. W. C., Macon, Ga., writes: We have a set of steel boiler rolls 6 inches diameter and 6 feet long, two rolls at the bottom and one in the center; we work them by hand—the top roll and one of the bottom rolls being the live rolls. I wish to change them to working them with power. What I wish to know is, if I gear both bottom rolls so as to make them run the same way, will they work successfully? Our boiler maker thinks they will. But I am afraid the sheet will not feed, or the top roll may stand still, and the bottom ones slip. Please give me your opinion. *A.*—We should gear the two bottom rolls; in fact, we do not see how you could place the gears in any other way if the upper roll is made to raise or lower, as we believe it is. Of course, we should not expect as good results as with a machine in which are used two pinching rolls, one directly over the other, both being driven, and a bending roll placed to one side of lower roll.

(242) R. C., Chicago, Ill., writes: I have read with interest your article on "What to Study." I am thinking of studying algebra, but would like to post myself in arithmetic, in which I am rather weak. Whose book would you recommend for self study? *A.*—See answer to Question 206, in our issue of May 7, current volume. 2. Is it usual in good office practice to ink in a drawing before tracing it? *A.*—Before blue printing was used, nearly all the drawings were inked before they were traced, and the drawings were kept for future reference. At present, nearly all the detail drawings are simply penciled, and then traced; a print is then taken from the tracing. The print is used in the shop, the tracing is filed, and the pencil drawing is thrown away, or the paper is used for some other purpose. General plans or drawings of intricate designs are generally inked before they are traced. Of course each establishment has its own rules in regard to this matter, and what is good practice in one office may not be considered to be good practice in another one.

(243) R., Chicago, Ill., writes: Can you inform me where to look for some reliable data on the efficiency of large upright boilers, say, 60 inches diameter by 16 feet high, having an internal fire-box, and as many 3 or 4-inch tubes as can be put in them? I have heard the claim made that they will evaporate 12 pounds of water per pound of coal. If this claim can be substantiated, this type of stationary boiler is decidedly economical in point of fuel consumption, as well as space and cost of setting. Will you kindly give me your opinion, and such data as you may have on the subject? *A.*—There are very few boilers, if any, that can evaporate 12 pounds of water per pound of coal, and we do not believe that this claim can be substantiated for the ordinary vertical boilers, as they are generally considered to be not as efficient as some of the other types. We do not know where you can obtain any reliable data. True, the simplicity of construction, the small ground space occupied, its convenience of working, and its being self-contained, are features which render the vertical boiler adaptable to the wants of a large class of steam users. On ships it is used with many variations of internal arrangements for auxiliary purposes, and then generally called the donkey boiler. It is used on a large scale by Scotch engineers for river steamers, where rapid evaporation is of more importance than economy of fuel.

(244) E. P. P., Dicky, Ga., writes: Please give me a good remedy for preventing the formation of scale in boilers. If kerosene is recommended, how much and how often should I use it? Can I use gum packing on the glass gauge? If not, what is the best kind of packing to use? *A.*—Kerosene has often been used with good results and it can be recommended. One quart of kerosene oil per day for a 100 horse-power boiler, and about a proportional amount for other sizes has been used with good results. The water should be blown down two gauges every week, and the entire contents every month. Rubber packing and kerosene do not agree. Use asbestos wicking dipped in boiled oil, and then squeeze dry for packing. 2. I am running a 5¾x9½ inch engine to run a lathe, shaper and drill press. Will a double engine with cylinders of the same size as above use more steam to do the same work, running at 150 revolutions per minute? *A.*—The double engine will use more steam. We do not see the object of increasing the size of engine, if the smaller one is large enough to do the work. 3. Will my boiler be large enough for the double engine? The boiler is 44 inches diameter, 9 feet high, with 75 flues, 2 inches diameter. *A.*—You do not give the steam pressure, nor the length of flues. If the engine has light work to do, the boiler is large enough. 4. What should be the diameter of the steam pipe? *A.*—For the double engine it should be 1½ inch diameter. 5. How much lead should I give each valve? *A.*—About $\frac{1}{32}$ of an inch. 6. What should be the size of shaft? It is 50 inches long. *A.*—For the double engine the shaft should be 3¼ inches diameter. 7. How heavy should the fly wheel be? It must be 36 inches diameter. *A.*—About 1,200 pounds.

(245) J. T. S., Providence, R. I., asks: By what means is the temperature of cast-iron at the melting point determined? I cannot conceive how any thermometer can be made to bear such a heat. *A.*—Pyrometers are used for determining degrees of heat higher than those which can be measured by ordinary thermometers. Although much ingenuity has been employed in the construction of pyrometers, great doubt is felt with regard to their accuracy, more particularly at very high temperatures. Numerous pyrometers have been devised by utilizing the expansion of air from heat. Where these instruments can be conveniently applied they are capable of yielding fairly accurate results. Another kind of pyrometers are founded on the property which clay possesses of contracting at high temperatures. The apparatus consists of a metallic groove, 24 inches long, the sides of which converge, being half an inch wide above, and three-tenths of an inch below. The clay is made up into little cylinders or truncated cones, which fit the top opening of the groove when they have been heated to redness; and their subsequent contraction, when still further heated, is shown by their sliding gradually down the groove till they arrive at a part of it through which they cannot pass. This measure of heat is no longer employed by scientific men, as its indications cannot be relied upon, owing to the variations in the quality of clay; but there are times when the principle involved in its construction may be of use for rough approximations of high temperature. In another class of pyrometers the temperature is measured by the expansion of a metal rod, enclosed in a case composed of blacklead and clay, in fact, of the same composition as a plumbago crucible, in which is drilled a hole $\frac{3}{10}$ of an inch in diameter and 7½ inches deep. Into this hole the cylindrical rod of soft iron or platinum of nearly the same diameter, and 6½ inches long, is introduced, so as to rest against the solid end of the hole; and upon the outer or free end of the metallic rod rests a cylindrical piece of porcelain, called the index. When the instrument is heated, the metal expanding more than the case presses the index forward, which, by means of a wedge, is kept in the position to which it has been forced, when the instrument is removed from the furnace and cooled. A scale is then attached to measure the precise extent to which the index has been pushed forward by the metallic rod; it thus indicates the difference between the elongation of the platinum rod, and that of the black lead which contains it. For its indications to be absolutely correct, it is necessary that the case and rod should expand uniformly, or both vary at the same rate. There are still other pyrometers arranged on different principles. For instance, those using the known melting points of solids; those depending on the chemical decomposition of solids, as Lamy's; those measuring temperatures by heating a known weight of water, and allowing to cool in it a known weight of platinum or other metal, which has been heated to the temperature of the space or of the body to be tested, as Pouillet's; those which determine temperature from the measures of strength of thermo-electric currents produced by heating the junction of two different metals, as Becquerel's; those which determine temperatures by the measurement of changes produced by heat in the electrical resistance of a length of platinum wire, as Siemens'; those which use the expansion of the wave length of a sound, which traverse a tube placed in the furnace whose temperature is to be measured, as Mayer's.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

George B. Grant—Gear Wheels. See p. 20.

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Send for Catalogue of Link-Belting.
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N. Y. City Bolt & Nut Co., Limited.

See Sterling Elliott's ad. on page 12.

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$13.00 I. Dea L. Drawing Stands. The original. Send for postal. W. S. Rogers, Troy, N. Y.

Get particulars of our new Wall, Suspended and Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

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S. A. Smith, 23 So. Canal St., Chicago, Ill., agent for Appleton Mfg. Co.'s Emery Grinding Machinery.

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Audubon Machine Works, New Haven, Conn. Electrical work, superior facilities. Builders of machinery, heavy and light.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

For best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th St., N.Y. Send for des'n.

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N. Y. City Bolt & Nut Co., Limited, 93 and 95 Desbrosses St., N. Y. City, manufacturers of Machine Bolts of every description. Write for estimates.

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DuBois & DuBois, Patent Attys., 715 11th St., Washington, D. C., procure first-class patents. Send stamp for illustrated pamphlet, "March of Invention," containing valuable information, and list of references

Patent Soliciting of High Class.
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Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations, 8vo, cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon, 12 Cortlandt St., New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Club Rates.—If no one is getting up a club for the AMERICAN MACHINIST in your town or establishment, send for Circular of New Club Rates, and try it yourself. Address AMERICAN MACHINIST, 96 Fulton St., New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2, postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

MANUFACTURES.

The erection of an electric light plant is talked of at Palatka, Fla.

C. F. Pekor is reported as to erect a machine shop at Columbus, Ga.

The Denver (Col.) Steel Co. is to erect a steel plant to cost $250,000.

The Norton Iron Works will rebuild its stock house at Ashland, Ky.

George Niebergall is reported as erecting a $10,000 ice factory, at Wheeling, W. Va.

The Bluefield Iron Works Company, at Bluefield, W. Va., is to increase its capacity.

The Davis & Furber Machine Company's foundry, at North Andover, Mass., is being enlarged.

J. B. Barrett & Co. will probably erect an iron foundry and machine shop at Wytheville, Va.

The Demorest Machine Works has erected buildings and started machine works at Demorest, Ga.

The Stanly Manufacturing Co. has been organized at Bilesville, N. C., with a capital stock of $25,000.

The Index Knitting Company is making an addition of 80x24 feet to its plant at Phœnix Mills, N. Y.

The Union Iron Works Co., of Selma, Ala., has reorganized recently, with a capital stock of $40,000.

It is reported that arrangements are being made for the construction of a rolling-mill at Cedartown, Ga.

An addition is to be built to the plant of the Hoskins & Hinnerth Foundry Company, at Highgate, Vt.

A $90,000 cotton-mill is to be established at Morristown, Tenn. I. J. Patterson can give information.

It is reported that the American Screw Company, of Providence, R. I., will establish a plant in England.

The Cable Iron Car Roofing Company, East St. Louis, has filed articles of incorporation; capital, $300,000.

W. H. Zinn, of Boston, Mass., is endeavoring to secure the establishment of a stove foundry in Anniston, Ala.

The Industrial Iron Works, at Bay City, Mich., are preparing to build an addition, 255x90 feet, to their works.

The business of the Lamprey Machine Company, of Lake Village, N. H., will be removed to Cambridge, Mass.

The Hendrick Manufacturing Co., of Carbondale, Pa., have broken ground for a new machine shop 140x40 feet.

The Darlington (S. C.) Manufacturing Co. will, it is stated, increase its capital stock, and the capacity of its cotton-mill.

A Schenectady (N. Y.) firm are arranging to erect a foundry at Lansingburgh, N. Y., which will employ about 100 men.

The Western Iron Company, of Kansas City, Mo., will remove its plant and effects to Kenilworth Station, same State.

A company is reported as to establish works for the manufacture of roller process flour-mill machinery, at Mound, W. Va.

It is stated that the Magnetic Machine Manufacturing Co., at Grand Rapids, Mich., will remove its motor works to Basic City, Va.

The Casey & Hedges Manufacturing Company, Chattanooga, Tenn., has, it is reported, increased the capacity of its boiler works.

An Ohio party is negotiating with the Charlottesville (Va.) Land Co. in regard to the establishment of iron works at Charlottesville.

Powell Clayton, L. H. Roots and R. C. Kerens have incorporated the Eureka Springs (Ark.) Electric Light and Street Railway Co.

The Nims Manufacturing Co. has been incorporated at Mt. Holly, N. C., for the purpose of building a cotton-mill at Nims Falls.

It is stated that investigations are being made looking to the removal of the Allston (Mass.) Steel Car Wheel Works to Knoxville, Tenn.

The Austin (Tex.) Rapid Transit Railway Co. is reported as to put additional machinery in, and increase the capacity of its power plant.

A stock company will probably be organized at Spartanburg, S. C., to manufacture the patent water motor invented by I. W. Garrett, Jr.

The Chesapeake & Ohio Railway Company has purchased over $50,000 worth of new machinery for use in its Clifton Forge (Va.) machine shop.

The Scott Machine & Hardware Company, at Denver, Col., are enlarging premises to double former size, and will put in several new tools.

The Globe Corrugating Co., of Cincinnati, Ohio, has, it is stated, purchased the Licking Iron Works at Covington, Ky.; will probably operate same.

The Puget Sound (Wash.) Wire Nail and Steel Company have organized, with a capital stock of $200,000, for the manufacture of nails and wire.

Nixon & West, of Chattanooga, Tenn., are erecting works for the manufacture of brass and iron shelf hardware, including casting and finishing.

John Ferrin, of West Virginia, is reported as having signed contract for the erection in Salem, Va., of a plant for the manufacture of steam boilers.

The Alcorn Woolen Manufacturing Co., Corinth, Miss., will, it is stated, put new machinery in its woolen-mills for the manufacture of jeans pants.

The Union Iron Works Co., Selma, Ala., has reorganized, with C. L. Peterkin as president and general manager, and is now adding boiler works.

It is reported that the car works of Rochester, N. Y., will remove their plant to Johnson City, Tenn., where $100,000 will be expended in establishing it.

Lee & Hoff are erecting a new plant at St. Paul, Minn., for the manufacture of boiler tube expanders, which will be double the capacity of the old plant.

The Sergeant Manufacturing Company, of Greensboro, N. C., is reported as enlarging its machine shops by the erection of an additional building 50x75 feet.

The Lehigh (Pa.) Rolling-mill is to be refitted for the manufacture of spikes. A new engine and other machinery will be added to the shop's equipment.

Work on the new erecting shops of the Merrill-Stevens Engineering Company, Jacksonville, Fla., progresses rapidly, and almost the entire framework is up.

The Youngstown Iron and Steel Company, Youngstown, Ohio, have bought the plant of the Youngstown Rolling-mill Company, the price paid being $195,000.

The Spang Steel and Iron Company, at Etna, Pa., is to make extensive additions to its plant, including furnaces, new buildings and machinery, at a cost of $250,000.

It is said that L. L. Hillman, vice-president of the Tennessee Coal, Iron and Railroad Company, and his associates, will build a million-dollar steel plant at Birmingham, Ala.

It is stated that R. P. Smith, of Houston, Tex., is investigating for an iron and steel works company that proposes to erect a $750,000 steel and iron plant at New Birmingham.

The Metal Construction Co., of Illinois, has been incorporated at Chicago, with a capital stock of $200,000. Incorporators, W. R. Norway, S. M. Randolphs and I. T. Dyer.

The Northwestern Engineering and Machinery Co., St. Paul, Minn., has been incorporated; capital, $50,000; incorporators, W. G. Strickland, Chas. A. Daigh and J. M. Badger.

J. M. Pickrell, of Mount Sterling, and others, have organized the Richmond Ice Manufacturing Company, for the purpose of erecting a $16,000 ice factory in Richmond, Ky.

The Wright Engine Works, Newburgh, N. Y., are building a large plant in that city, which, for convenience in the handling of work, will not be surpassed by any in the country.

A Mississippi party is in correspondence with the Board of Trade relative to the organization of a stock company for the purpose of erecting a $40,000 cotton-mill in Shreveport, La.

Swift's Iron and Steel Works, located at Newport, Ky., and lately purchased by the Cincinnati Corrugated Iron and Steel Co., will commence operations some time in May.

The Kensington (Pa.) Steel Company is the name of a corporation which is at present negotiating for the purchase of a site for a fine open-hearth and crucible steel works at that place.

Plans and specifications of the roundhouse and shops of the Houston & Texas Central to be built at Ennis, Tex., have been completed. The grading of the grounds has been commenced.

At Baltimore, Md., J. J. G. McShane, Edwin Howland, G. H. Rogers and others, have incorporated the Henry McShane Manufacturing Co., to operate the McShane bell and iron foundry.

It is stated that the Union Steel Works, at Louisville, Ky., will remove their plant to Lexington, Va., at an early date. They have a capital stock of $1,000,000, and will employ 300 operatives.

It is reported that the Elizabeth Land and Improvement Company, Pittsburgh, Pa., has made a sale to a Chicago firm of fourteen acres of ground, on which a safe and lock works will be erected.

The Ellis & Lessig Steel and Iron Company, Limited, of Pottstown, Pa., have decided to rebuild their plant at that place, and not to remove to Salem, Va., as previously announced by them.

Very considerable enlargements and additions will be made this season and next by the Pitman Manufacturing Company, knit goods, Laconia, N. H. New buildings, valued at $20,000, will be erected at once.

The Roiled Steel Wheel Company, of Pittsburgh, Pa., will erect a plant at Kensington, on the Allegheny River, to manufacture steel wheels for vehicles, and other specialties. The capital stock is $600,000.

R. T. McDonald, M. J. Hart, R. DeVerges and others, of New Orleans, La., have incorporated the Municipal Ice Manufacturing Company, for the purpose of manufacturing ice, etc. The capital stock is $250,000.

The Wallace & Graves Machine and Foundry Company have filed articles of incorporation at Lafayette, Ind. The capital stock of the company is $20,000, and they will manufacture steam boilers and castings.

It is reported that the Thomas Manufacturing Company, Little Rock, Ark., will erect a three-story addition to its present plant, and put in machinery for the manufacture of the Gwathmey patent cotton gin.

W. H. Quick, of New York; E. D. Crook, G. A. Horner and others have incorporated the Steam Coil & Pipe Heating Co., at Baltimore, Md., to manufacture machines for cleansing coils and pipes. The capital stock is $250,000.

The Weeks Automatic Car Coupling Company, of New York City, has been incorporated, with a capital stock of $100,000; incorporators, Clayton Weeks, of Hobart; Charles Bray, of Kingston, and B. C. Andrews, of New York.

The Charlestown Mining, Manufacturing and Improvement Co. has contracted for the establishment at Charlestown, W. Va., of boiler works, and also for the removal of the Vulcan Road Machine Works, of Kennett Square, Pa.

The furnace of the Lone Star iron works at Jefferson, Tex., is now turning out fifty tons of iron per day, having begun operations March 17. The directors of the company have voted to establish a steel plant at an estimated cost of $1,000,000.

The Elyton Land Co., of Birmingham, Ala., has voted a subscription of $100,000 to the stock of the company which T. T. Hillman and associates, of Birmingham, are organizing, to build a $1,000,000 steel plant at Ensley City, near Birmingham.

The extensive foundry and hardware manufacturing works of H. R. Ives & Co., at Longueuil, Que., near Montreal, destroyed by fire several months ago, are about to be rebuilt. The new works will give employment to about 125 hands.

When the Audubon Iron Works are in full operation, New Orleans, La., will enjoy facilities for the repair and building of vessels not possessed by any other city on the Gulf coast, and work will be done at home that formerly had gone to Philadelphia, New York and other points.

Important improvements are shortly to be made to the Thomas Furnace at Niles, Ohio. A new cast house 100x70 feet will be erected, and a large blowing engine and two batteries of boilers put in. These and other improvements will materially add to the capacity of the furnace.

The Webster, Camp & Lane Machine Company, Akron, O., contemplate the erection of several more brick buildings of large dimensions to their present plant. They have recently added $15,000 worth of new tools, and keep 225 men busy on steam engines and mining machinery.

It is reported from Knoxville, Tenn., that a steel car works plant on a large scale is to be established at Watauga, the machinery to be removed from Boston, Mass., and that the capitalists who own it are soon to be in Watauga to select a site. The plant is said to be a very extensive one.

Recent severe tests of rawhide pinions made by the New Process Rawhide Company, of Rochester, N. Y., have shown the most favorable results. These tests were made on the Federal street and Pleasant Valley Railway Company, in Allegheny, Pa., where there are grades of 12½ per cent.

The Benwood Iron Works at Wheeling, W. Va., has commenced the work of tearing out the plate-mill in its forge, and will put in its place a sheet-iron-mill. The company has been at work on nails and muck-iron for several years exclusively, and proposes to get into some more lucrative business.

The plant of the St. Louis Steel Foundry Company, recently damaged by fire, is being put into shape for a resumption of operations. The machinery was only slightly damaged, and engines and boilers were uninjured. The plans for the works contemplate largely increased room and capacity.

The S. J. McCormick Company, of Pittsburgh, Pa., for the manufacture and sale of foundry, facing and mill supplies, with a capital of $50,000, has been chartered at Harrisburg. The directors are John S. McCormick and Frederick S. Hamm, of Pittsburgh, and M. Hawley Treadwell, of New York City.

It is proposed to establish a rolling-mill at Sheffield, Ala., where a number of blast furnaces have been built. Thirty-five miles from Sheffield, oil has been struck at a depth of 800 feet. It is a heavy, lubricating oil, and the wells already drilled are producing a profitable quantity. Quite a field is being developed.

The Toledo, St. Louis & Kansas City is erecting new shops at Frankfort, Ind. It is expected they will be completed and equipped with machinery by July. The buildings are of brick, resting on stone foundations, and will have slate roofs. A roundhouse, which will hold tweive locomotives, is already completed.

A dispatch from Anniston, Ala., of April 5th, says that the Anniston Pipe Works have been leased to a Cincinnati, O., party, who will put them in operation in a few weeks. This is one of the largest plants of the kind in the country, costing over $500,000 to build it. It went into a receiver's hands three months ago.

The city of Duluth, Minn., is endeavoring to secure the location of a smelter of the Calumet & Hecla Co., now at Lake Linden, Mich., which was reported to be located in Buffalo, and to employ about 400 men. Among those interested are the Ironton Land Co., E. C. Gridley, Judge J. T. Hale, Lovett & Brown, and others.

The entire plant of the Katahdin Iron Works, in the State of Maine, has been purchased by a syndicate, and will be transferred to East River, in Pictou County, where iron is abundant. Over 300 hands will be employed. Among those interested are Mr. Fraser, of New Glasgow; R. G. Leckie, of Londonderry, and Mr. Sjostet.

President Williams, of the Muskegon Iron and Steel Works, at Muskegon, Mich., has made arrangements at Pittsburgh for machinery to be used in the steel manufacturing plant that is to be added to the iron works. Two melting furnaces, each of 15 tons capacity, and capable of three heats in 24 hours, will be constructed at once.

The capital stock of the Ticonderoga Machine Company, Ticonderoga, N. Y., has been increased from $30,000 to $125,000, and an addition is being built to the old machine shop, which will be 144x80 feet. The building will be of brick, and equipped with the most modern machinery for the manufacture of mining machinery and gas engines.

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It is proposed to organize a $200,000 stock company to manufacture, in Roanoke, Virginia, the patent automatic slot machine of N. C. Dietrich, erecting a $25,000 plant for the purpose. This is to be a branch of the home company to be organized in Washington, D. C., with $1,000,000 as capital. J. U. O'Meara, of Washington, D. C., can give particulars.

Robert A. Carter, formerly foreman of Singer, Nimick & Co.'s mill, has purchased a tract of 80 acres at Hays Station, on the Monongahela River, near McKeesport, Pa., for a manufacturing site. A corporation has been formed, with a capital stock of $100,000 to erect a rolling-mill, with a finishing department, and the contracts will be let at once.

The Wilkes Rolling-mill Company have been organized, at Sharon, Pa., by John B. Wilkes and others, all practical iron men. P. L. Kimberly, of P. L. Kimberly & Co., Limited, proprietors of the Atlantic Iron and Nail Works, at Sharon, Pa., has donated sufficient ground near his works for the erection of the new plant, which will manufacture muck bar exclusively.

J. M. Risher, assignee of L. D. Risher, has closed the sale of a manufacturing site to Robert O. Carter. This site is for the proposed iron-mill at Hays Station, Pa., which is to be conducted by the workingmen, who have formed a corporation, with $100,000 as the capital stock. They will build a rolling-mill, with a finishing department, employing together about 200 hands.

The Hackney Hammer Company, of Cleveland, Ohio, have issued an illustrated and descriptive catalogue of their pneumatic power hammers, which gives full information regarding them. It is accompanied by fac-simile reproductions of letters received by the company from users of the hammer, relating their experience with it. It will be sent to any reader of this paper upon application.

The Northern Pacific proposes to build new machine shops at Missoula, Mont. It is also to build a freight house. The various improvements at this town will probably amount to $60,000. The company is to build a roundhouse and repair shops at Ocasta, Wash. Plans have been prepared for a bridge and a stone passenger station, to cost $100,000, which it is proposed to erect at the foot of Columbia street, in Seattle. The building of the station will probably be delayed a year to secure a clear title to the site.

President Hunt, of the South Boston Iron Works, says, in a recent letter, that the plans for the new works to be built at Middlesborough, Ky., will be forwarded in a few days. It is understood in this connection that the concern's financial arrangements, looking to removal to Middlesborough, have been perfected, but the directors are considering the advisability of an increase of the capital stock to $1,000,000. When the buildings at Middlesborough are completed, the machinery in the South Boston plant will be conveyed to Norfolk, Va., by water, and thence transported to its destination by rail.

Stone's Patent Bronze.

In the *Engineer* (London) we find an account of a new patent bronze, and from this account glean the following statements:

For many years it has been fully recognized that both cast-iron and steel are very far from being the ideal material for use in the construction of ships' propellers. Cast iron at the best is but a poor material for the purpose, and is only retained in use on account of its cheapness and the ease with which it can be cast approximately to the required shape, much less experience being necessary than in the casting of other materials. Cast steel is a much superior metal, but is difficult to cast and anneal so as to preserve the form the propeller is intended to have. Want of truth of form is a very serious defect in a propeller; but there is even a still greater inherent fault in cast-iron and steel, viz., "pitting," due to the corroding action of the sea water, which is greater the warmer the climate. Owing to the roughened surface of the blades, a greatly increased expenditure for fuel is necessitated in order to get the same duty out of them that they would give when new; besides which, the blades become useless in a few years and have to be replaced, and the old material is practically worthless. To remedy defects in form, due to the nature of the material, it is possible to do but little. Something may and has been done to preserve a better surface on the blades by applying in various ways a thin coating of brass or copper, but none of these devices can be said to be practically successful.

The old adage, that "Prevention is better than cure," holds good in this as in other cases. Following the advice of the adage, many attempts have been made to manufacture a suitable bronze or brass alloy which should not have the defects so objectionable in cast-iron and steel for propellers. That these attempts have at last resulted in success there is now no doubt whatever. In the front rank of workers in this direction have been Messrs. J. Stone & Co., of Deptford, London, who for upwards of forty years have devoted special attention to the manufacture of alloys for railway and naval purposes. In conjunction with Professor

Huntington this firm has for several years carried on expensive and laborious experiments, with the object of producing a really trustworthy and in every way satisfactory material for propellers, and until they felt quite sure they had succeeded, no attempt was made to induce those interested in shipping to use it; but in a comparatively short space of time this firm has fitted over fifty of these propellers in vessels of all classes, including mail steamers, ironclads, cruisers, torpedo catchers and boats, cargo vessels, etc., and in no case has anything whatever gone wrong.

When melted this alloy runs freely, and with proper care produces perfectly sound castings of a fine close grain and true in form. The surfaces of the propeller blades being much smoother than in the case of steel, the propellers work in more solid water, increasing greatly their efficiency, which is obtained not merely at first, but permanently, because this alloy, unlike steel, is not attacked and pitted by the sea water. The efficiency of steel blades decreases rapidly, whilst it is practically constant for the bronze alloy; thus an increased speed is obtained for the same consumption of fuel, or the same speed may be maintained with a decreased consumption of fuel, either of which represents a considerable gain from a monetary point of view.

It is not, however, fair to credit the perfection of the casting and the smoothness of the surface with all the advantages gained by the use of these special bronzes. Part of this gain is undoubtedly due to its being possible to make a much finer and more theoretically perfect blade than with gun-metal, which is weaker; or with steel, which becomes reduced in quality by corrosion. The question of cost must not be overlooked in our search for efficiency; but even in this, where the bronze might expect to be at a great disadvantage as compared with steel, it proves in the long run to be economical. Thus, if we assume the average life of a vessel to be, say, sixteen years, the propeller, if of steel, would have to be renewed four times; whereas, if it were made of bronze, it would last the whole of that period. Therefore, even if the price of this alloy is taken at double that of steel, there will be a saving of one-half in the cost of the propeller during the life of the vessel. In this calculation the time lost and expense incurred in renewing the steel blades, which are a dead loss to the ship-owner, are not taken into account, to say nothing of the saving in coal bills, which alone would pay for the total cost of the propellers during the life of the vessel over and over again.

In these days of keen competition and narrow margins, shipowners cannot afford to neglect anything which will, in however small a degree, give them an advantage. Practical experience has shown that the gain in using bronze propellers is considerable, and one which, already recognized by very many, before long must inevitably be taken advantage of by all.

A summary of the results of test made and certified to by Professor Huntington is as follows:

Two bars, ½ inch diameter by 2 inches long on tested part, cast in sand, of a quality suitable for propellers, were tested for tensile strength. One bar showed an elastic limit of 17.05 tons, and a breaking strain of 33.20 tons per square inch. The other bar showed an elastic limit of 17.05 tons, and a breaking strain of 31.84 tons (2,240 pounds per ton) per square inch.

A bar ½ inch diameter, 1 inch long, of a quality suitable for propellers, cast in sand, was used in the test for resistance to compressive strain. The ultimate compressive stress was 127,356 pounds per square inch.

Sketches of an Apprenticeship.

BY W. S. ROGERS.

The Old Man was always on the lookout to see that us cubs didn't get discouraged, and leave for some other shop. Not that the other shops were any better than ours or their apprentices any better paid or taught, but you know boys do get ideas, sometimes, that a change would be beneficial, and they make it, becoming "run-away cubs," and ending in being "chased-away" machinists the rest of their lives. The Old Man thought so ill of a run-away cub that he would not allow one to look in the shop doors if he could prevent. There was a youngster in the place who had served about a year in one of the large shops, and "learned it all," and had started a genuine machine shop in his father's back yard. The loving parent had bought the boy a small planer, lathe, drill press, shaper and forge, and given his genius full opportunity to grasp fame. The newspapers were full of glowing accounts of his doings, and he gained quite a local reputation as the "boy mechanic." John and I would often call on him during our half days off, and envy his good fortune, and one day at our shop, in talking with the Old Man on the subject, and commenting on this boy's chances to outstrip us in the battle of life, he suddenly turned the conversation, and said, "John, bring me a piece of pig-iron; Rogers, go and get me a piece of bar-iron from the store-room." Upon our return he took the two pieces of metal, and asked, "If you were told to make a key or a wedge for some important part of a machine, which one of these pieces would you take?" We both grasped the nice smooth bar-iron and replied, "This." "Why?" he asked. "Because it is all ready for use," said I. "Your answer, John," said the Old Man." "'Cause it's—it's been ed-u-ca-ted," replied John, as he choked on the last word. The Old Man's eyes twinkled, and he said, "At the end of your time, the difference between you boys and the run-away boy mechanic will be just the same. See?" We saw, and remembered the lesson.

Some months ago, while *en route* through my old home, I became curious to know what had become of the "boy machinist" of twenty years ago, and I stopped off and wandered around to see him, and bless you, there was the same old shop, the same tools grown old, and in the man sitting by the stove, smoking his pipe, I recognized the old-time boy machinist. He had forgotten me, and when I inquired if he didn't want to hire a hand, he said, "No, I can do all that comes in." Verily, the Old Man's illustration was good. The chunk of pig-iron doesn't get refined or educated, as Johnnie expressed it.

Lathe Chucks.

The illustrations on this page represent some of the latest forms of lathe chucks as manufactured by the Skinner Chuck Company, of New Britain, Conn. Figs. 1 to 4 show the universal chuck as it is made in the larger sizes, from 15" up to the largest. It is, of course, made with three jaws instead of four, if desired, and while the screws and nuts formed on the jaws are accessible for inspection and oiling, the circular rack and pinions are thoroughly protected from dirt and chips. When it is desired to use this as an independent chuck, the rack may be readily removed.

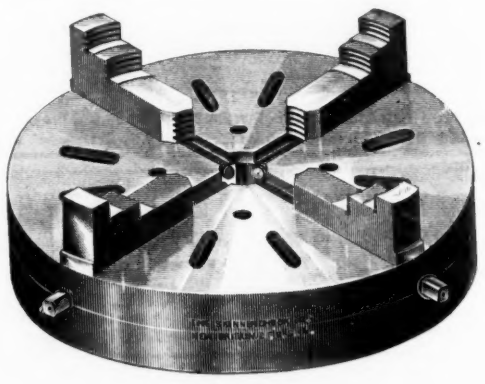


Fig. 1.

Fig. 3.

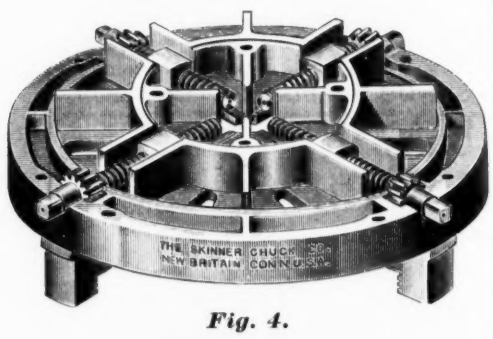


Fig. 4.

Fig. 2.

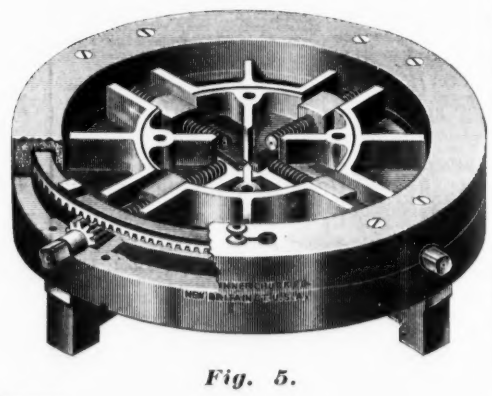


Fig. 5.

LATHE CHUCKS.

Figs. 5 and 6 show the combination chuck, in which provision is made for throwing the circular rack out of gear with the pinions when it is desired to use the chuck independently. This is done, as shown, by moving a ring, which extends entirely around the chuck, and thus supports the rack at all points. It is advanced or thrown back by means of lugs, which are formed solid with this ring, and which, in connection with pockets formed in the case, act as cams, there being one of these cams opposite each pinion. Either of these chucks is made with any style of jaw desired.

In the *Safety Valve* for May we find strong evidence of thorough appreciation of the AMERICAN MACHINIST. The first of these is a very flattering editorial item highly commending our conduct of the paper, which is all very well in its way; but when we turn over further we find still stronger evidence of this appreciation in the publication of our illustrated article (issue of May 7) on the New Engines of the Rhode Island. This article is reproduced verbatim, including the cuts, except that the latter are reduced in size, and there is absolutely nothing to indicate the origin of the article, or that it did not originate with the *S. V.* Pains have been taken even to omit our signature on the cuts, which were prepared by us at considerable expense from drawings made in this office. While this is appreciative, it is true, we cannot commend such performances. We are willing that other journals should make use of our columns as much as they choose, but we insist that full credit for everything used is the only fair way of making such use of them.

Henry R. Worthington has recently put in a pumping engine at Chicago, in which the water end, particularly, is of new design, making it not only very neat in appearance, but very convenient in respect of access to valves, and for repairs. It is a compound duplex engine with cylinders 33" and 66" diameter, 48" stroke, runs at 130 feet piston speed, and is capable of delivering 16 million gallons per day. It is a "high duty" engine, with compensating cylinders for enabling steam to be used expansively, and at 100 feet piston speed the duty obtained was 118,000,000 foot-pounds on coal fed to boilers.

Mr. E J. Armstrong, M. E., who has for some time past been connected with the Straight Line Engine Co., at Syracuse, and who is well known to readers of the AMERICAN MACHINIST, has accepted a position with A. Robb & Sons, of Amherst, Nova Scotia, whose works, having been destroyed by fire last fall, are now to be reorganized and devoted especially to the production of a high-speed automatic engine. The engine is to be newly designed by Mr. Armstrong, and special tools and methods of manufacture are to be used in its production.

Mr. James Tribe, who for nine years past has been connected with the Corliss Steam Engine Company, of Providence, as draftsman, the last five years of which time he was head draftsman, has left the company and has opened an office at room 27, Butler Exchange, Providence. He will do general mechanical engineering work, and will furnish complete working drawings for steam or other machinery.

Machinists' Supplies and Iron.

NEW YORK, May 23, 1891.

Iron—American Pig—Prices are steady, and the market is firm.

We quote: No. 1 Foundry, Standard Northern brands, $17 to $18; No. 2 is selling at $16 to $17, and Gray Forge at $14 to $14.50. Southern brands of good quality are obtainable at $16 to $17.50 for No. 1 Foundry; and $15.75 to $16 for No. 2; and $14 to $14.50 for No. 3.

Scotch Pig—We quote at $24.50 for Coltness; $22 for Dalmellington; and $20.50 for Eglington.

Copper—The stagnation in the copper market is causing easier prices. Lake copper is offered at 13c. to 13¼c., without any one willing to invest at that price. Arizona Ingot is quoted at 12½c. to 13c.; casting copper is quoted at 11¾c. to 11½c.

Lead—The market continues steady at previous figures, but trading is insignificant. Spot lead is quoted at 4.30c. bid, and 4.37½c. asked.

Spelter—The tendency of the market is said to be stronger. There have been more inquiries, and the near approach of the time when the annual contracts have to be renewed seems to point to higher prices. For shipments, 4.90c. is asked, but less may buy some brands.

Tin—The market is quiet and steady. Sales have been made at 20.35c. and 20.50c.

Antimony—The market remains barely steady here and abroad.

We quote Hallett's at 15c. to 15¼c.; Cookson's, 16¼c. to 16½c.; and 15¼c. for X. L.

Lard Oil—The market is easier at 54c. to 55c. for Prime City, according to holder and quantity.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Agents in every shop for fine tools; big inducements. Address E. G. Smith, Columbia, Pa.

Position by asst. mech. draftsman, 3 years' drawing-room and shop exp. T Square, AM. MACH.

A draftsman; one familiar with marine work preferred. Address Lock Box 3, East Boston, Mass.

A skillful mechanical draftsman and designer desires engagement. Address Box 87, AM. MACHINIST.

Wanted a first-class draftsman and machine designer, with exp. Address Box 93, AM. MACHINIST.

Wanted—Draftsman who is familiar with engine work, competent to design; state salary required, and experience. Robt. Wetherill & Co., Chester, Pa.

Brass molder, a sober, industrious man, wanted; must thoroughly understand the mixing of metals. Apply corner of Grand and Sheriff Sts., New York.

Draftsman familiar with gearing, jig-making and reg. shop work, wants position. H. M., AM. MACH.

Wanted—A superintendent of foundry, machine and boiler works. Address with reference, stating qualifications and salary expected; good opening for the right man. Address Foundry, AM. MACHINIST.

Wanted in a large manufacturing establishment, two bright young men as draftsmen; hours 7 to 5:30. Address Post-office Box 1582, Philadelphia, Pa., stating age, experience, and salary expected.

Wanted—A man competent to run and take care of polishing wheels on iron and brass printing press work. Give age, experience, and present employers. Address Taunton Locomotive Mfg. Co., Taunton, Mass.

Wanted—Position as superintendent by machinist and tool maker; 20 years' experience; accustomed to handle men; state salary, and what will be expected of the right man; references. Address, Box 90, AMERICAN MACHINIST.

Wanted—By mining company in Mexico, first-class molder; man that is capable of mixing charges and able to run cupola; location very healthy; engagement for four months. Address, giving particulars, reference and terms, Box 89, AM. MACHINIST.

Wanted—At Pittsburgh Locomotive Works, Pittsburgh, Pa., a competent foundryman to take charge of iron and brass foundries; must be active, entirely temperate, and thoroughly understand locomotive work; state salary expected, and give references.

Wanted—Foundry foreman; must be acquainted with all kinds of work; heavy castings, both loam and dry sand. Give full particulars, references, age, compensation, etc.; works in Pennsylvania. Address Box 95, AMERICAN MACHINIST.

Wanted—Machine shop foreman, capable of handling men, and understanding modern methods of work; give references, age, and compensation expected; shop located near Philadelphia. Address Box 96, AMERICAN MACHINIST.

Wanted—Position as supt. or foreman, by a young man, 36, successful in the systematic manufacture of machinery and mechanical devices, and in the economical management of men; a designer and draftsman of automatic and interchangeable machinery, tools, jigs, etc. W. H. S., Box 197, Burnside, Conn.

Wanted—By a large Baltimore machinery house, a young active man who has been brought up in the engine business, who is thoroughly familiar with steam engines, boilers and steam pumps; applicant must be an expert in steam, and should have some knowledge of drafting and erecting. In applying state age, occupation, and give as full personal details as possible; also give references. Address Box 94, AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

All sizes punch presses & dies. R.T. Lane, Clev'd, O.

Special wire mach'ry. Amer. Tool Wks., Clev'd, O.

Bowsher's Balancing Ways. See adv., page 17.

Just out: aluminum steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Wanted—Customers for our new Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

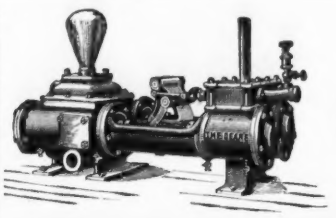
Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Wanted—Agents for the best surface gauge in the market. Particulars address W. H. Ermentrout, 141 N. Fifth St., Reading, Pa.

Engine for sale; 55 H. P. Watts-Campbell slide valve engine in good order; will be sold cheap. F Berg & Co., Orange Valley, N. J.

Wanted—Partner with $5,000 or $10,000 in an established boiler works manufactory, to increase the business; land, buildings and machinery unincumbered; splendid chance for right man; or would form stock company. Box 863, Warren, Ohio.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.



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DEANE STEAM PUMP CO.,
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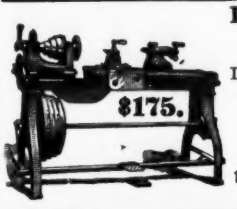
MAKERS OF
FINE STEEL
For Dies, Punches, Taps, Reamers, Cold Chisels, Lathe Tools, Shear Blades, Milling Cutters, Etc., Etc.



Improved Screw Cutting Foot and Power. LATHES
Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.
THE SEBASTIAN-MAY CO.,
167 to 175 Highland Avenue, SIDNEY, OHIO.
MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

TOBIN BRONZE
Send for Circular.
Tensile Strength upwards of 79,000 lbs. per sq. in.
Torsional Strength equal to the best Machinery Steel.
Anti-Frictional and Non-Corrosive.
CAN BE FORGED HOT.
Round, square, and hexagon bars for pump, piston rods, bolts and screws. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Spring wire.
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Sole Manufacturers
19 & 21 CLIFF ST., NEW YORK.

FINE TAPS, DIES, REAMERS, Etc.

LIGHTNING AND GREEN RIVER Screw Plates.
Bolt Cutters, Hand and Power Drilling Machines, Punching Presses, Tire Benders, Tire Upsetters and Other Labor-Saving Tools. Send for Price List.
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For TOOLS, DRILLS, DIES, &C.
All Kinds in Stock.
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MANUFACTORY,
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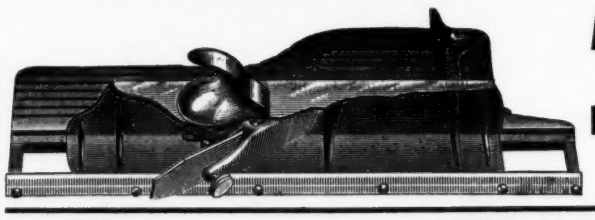
PATTERN MAKERS' SHOOT PLANE & JACK BOARD.

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Box 3600.
BOSTON, MASS.
SEND FOR CIRCULAR.

"TIME IS MONEY."
"The smith his iron measures
Hammered to the anvil's chime."—Longfellow.
"And his BRADLEY HAMMER treasures,
Since it saves him work and time."—Some-other-fellow.
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JOHN WILEY & SONS, NEW YORK.

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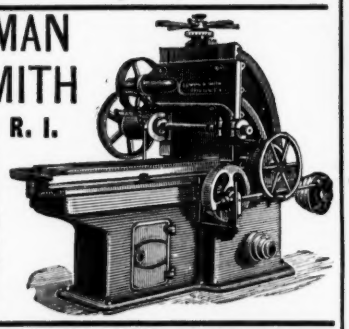
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(Formerly with Corliss Engine Co., Prov., R. I.)
MANAGEMENT OF THE CORLISS ENGINE,
By C. D. THURBER.
UNIFORM IN ONE VOLUME, $1. Free by mail.
This is a concise work fully illustrated, with directions for setting valves, running high and low pressure, and compounds; intended for practical men. Fully endorsed by leading trade papers. Contains no advertisements, and no fakes of any kind. EGBERT P. WATSON & SON, Room 57, 150 Nassau St., New York.

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WILMINGTON, DEL.
Makers of Implements for Standard Measurements.

Over 48,000 in Use.
Crescent Gauge. Flat Bar Gauge.
JAS. A. TAYLOR & CO.

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FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.
We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.
H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.

DO YOU
WANT READY MADE BUSINESS?
I have recently organized a Stock Company for the purpose of pushing the manufacture and sale of my Hickory Bicycle, and we find it impracticable to make in the same factory the various tools, &c., which have been heretofore made by me, and as I am bound by my agreement with the Elliott Hickory Cycle Co. to give my entire time and attention to that, I am obliged to dispose of the following, together with all Patents, Patterns, Tools, Cuts, Stock on hand, business and good will.
The Elliott Pamphlet Stitching and Tying Machine.
" " Drill Press.
" " Centering Attachment.
" " Cutting-Off Tools, No. 1 and No. 2.
" " Tap Drill Gauge.
" " Non-corrosive Soldering Fluid.
The above may be had together or separately, and will be sold to whoever makes the best offer before July 1st.
All pertinent (and possibly some impertinent) questions will be promptly answered by addressing
STERLING ELLIOTT,
NEWTON, MASS.

R. MUSHET'S SPECIAL and TITANIC STEELS.
How to get the best results with "R. MUSHET'S SPECIAL STEEL." Greatly increase your speeds and feeds; then compare the work you turn off with that done by any other known Steel. This will make the first cost of "Mushet's" look insignificant.
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Sole Representatives in the United States.
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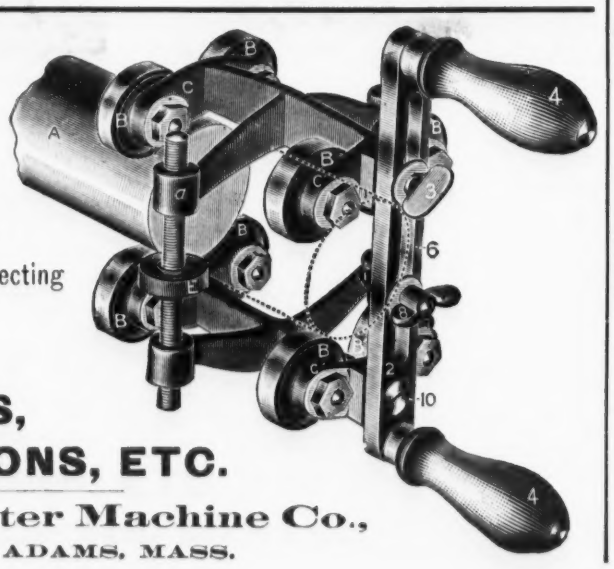
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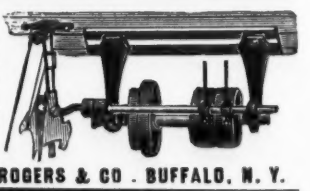
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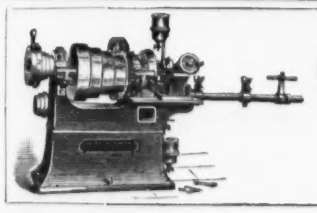
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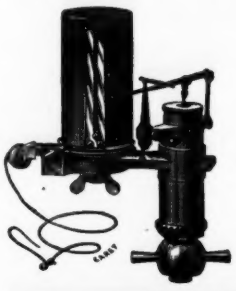

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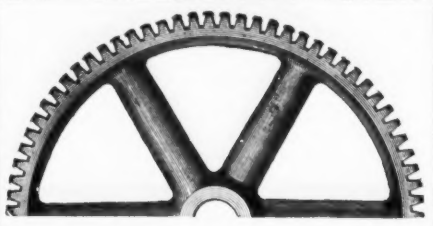

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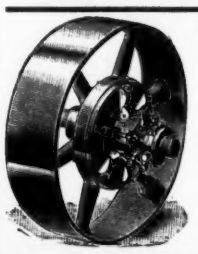

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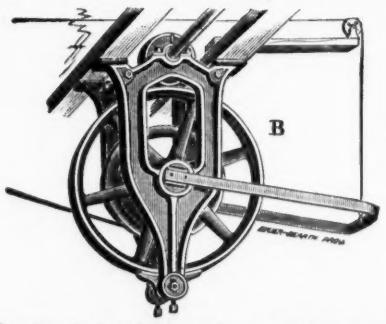

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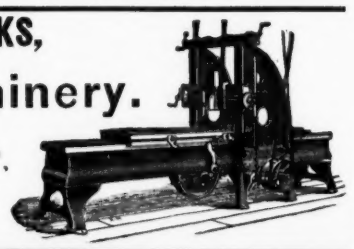

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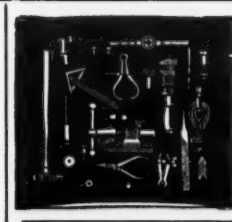

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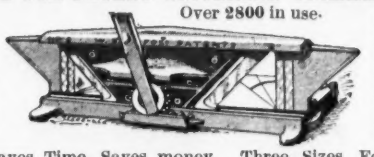

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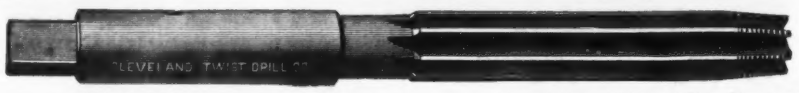

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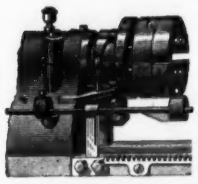

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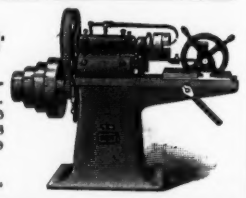

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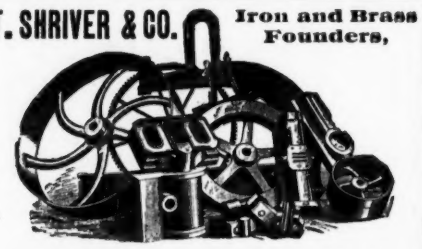

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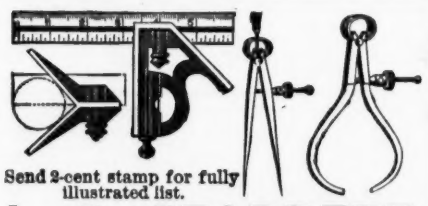

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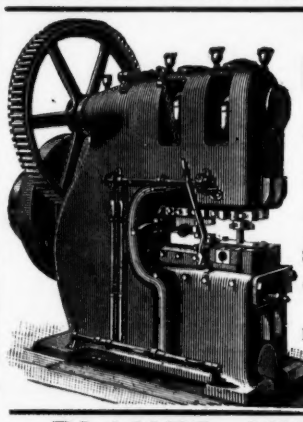

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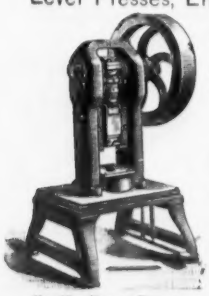

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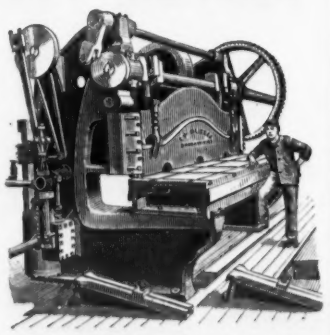

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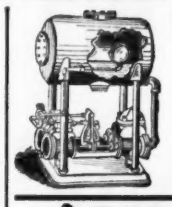

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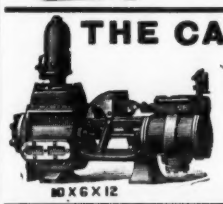

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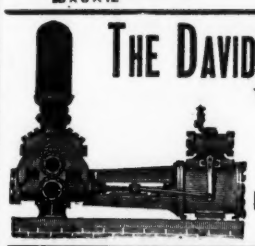

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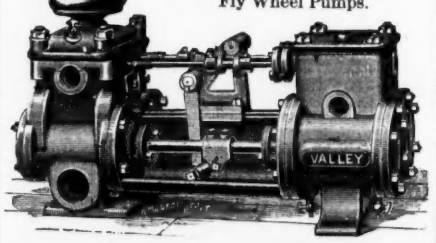

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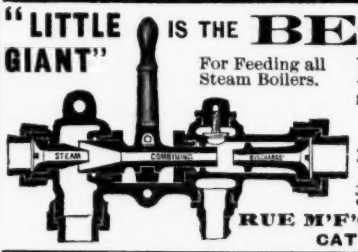

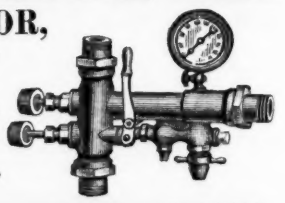

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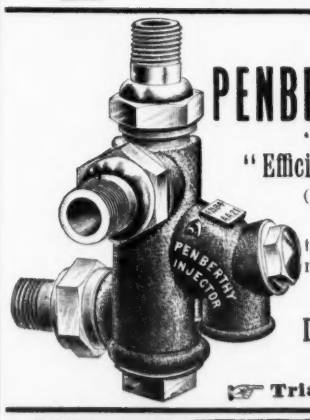

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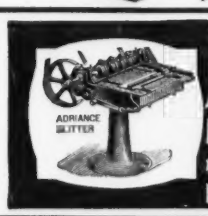

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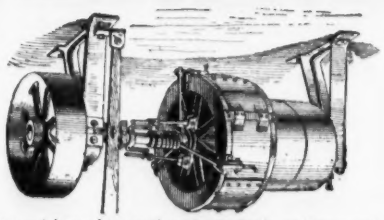

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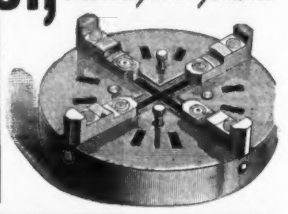

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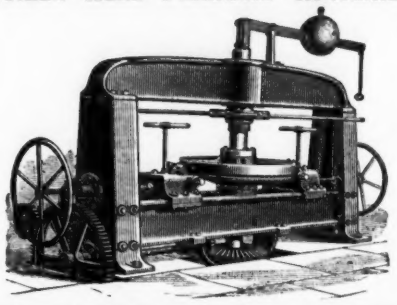

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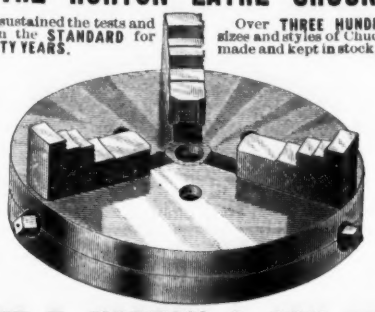

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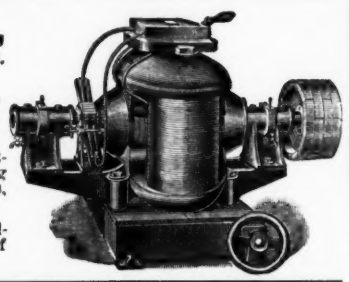

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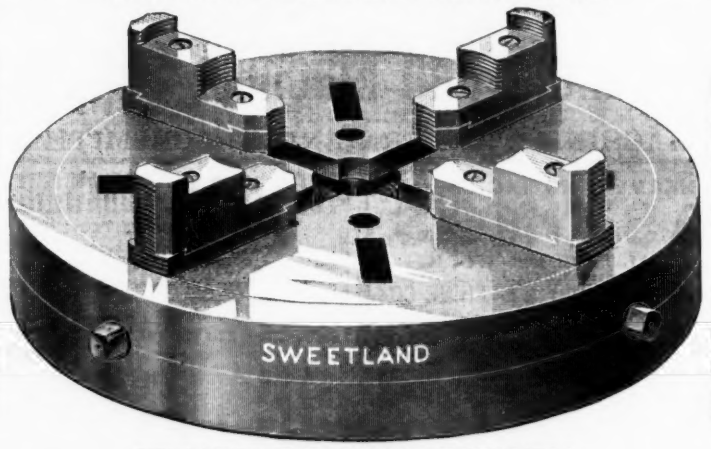

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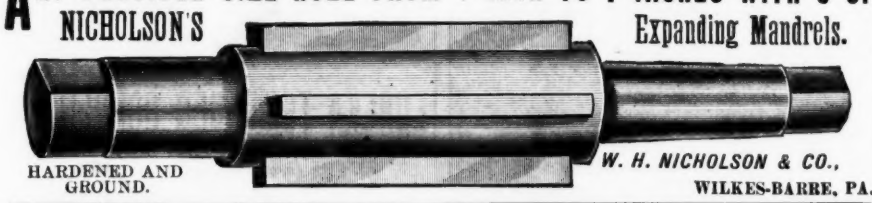

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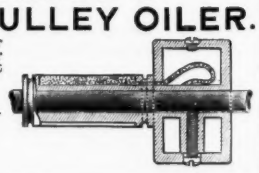

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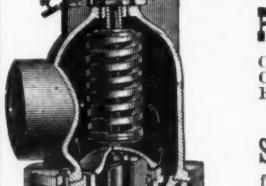

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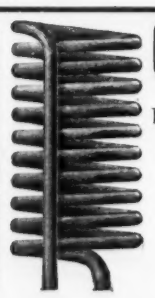

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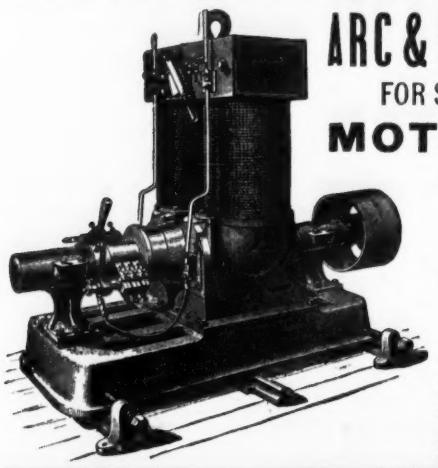

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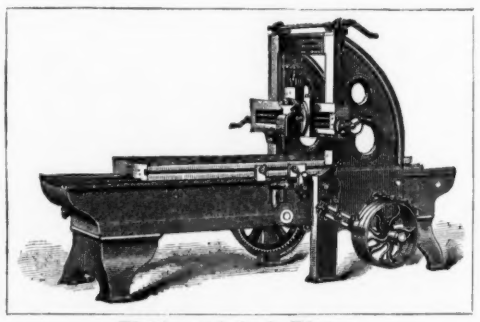

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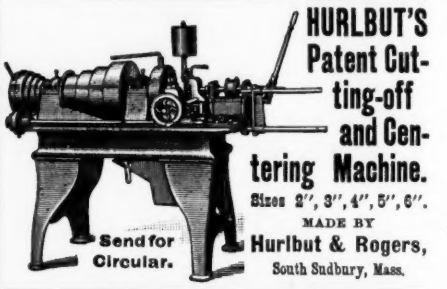

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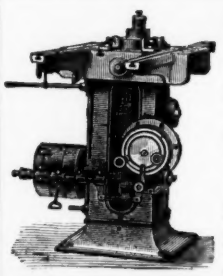

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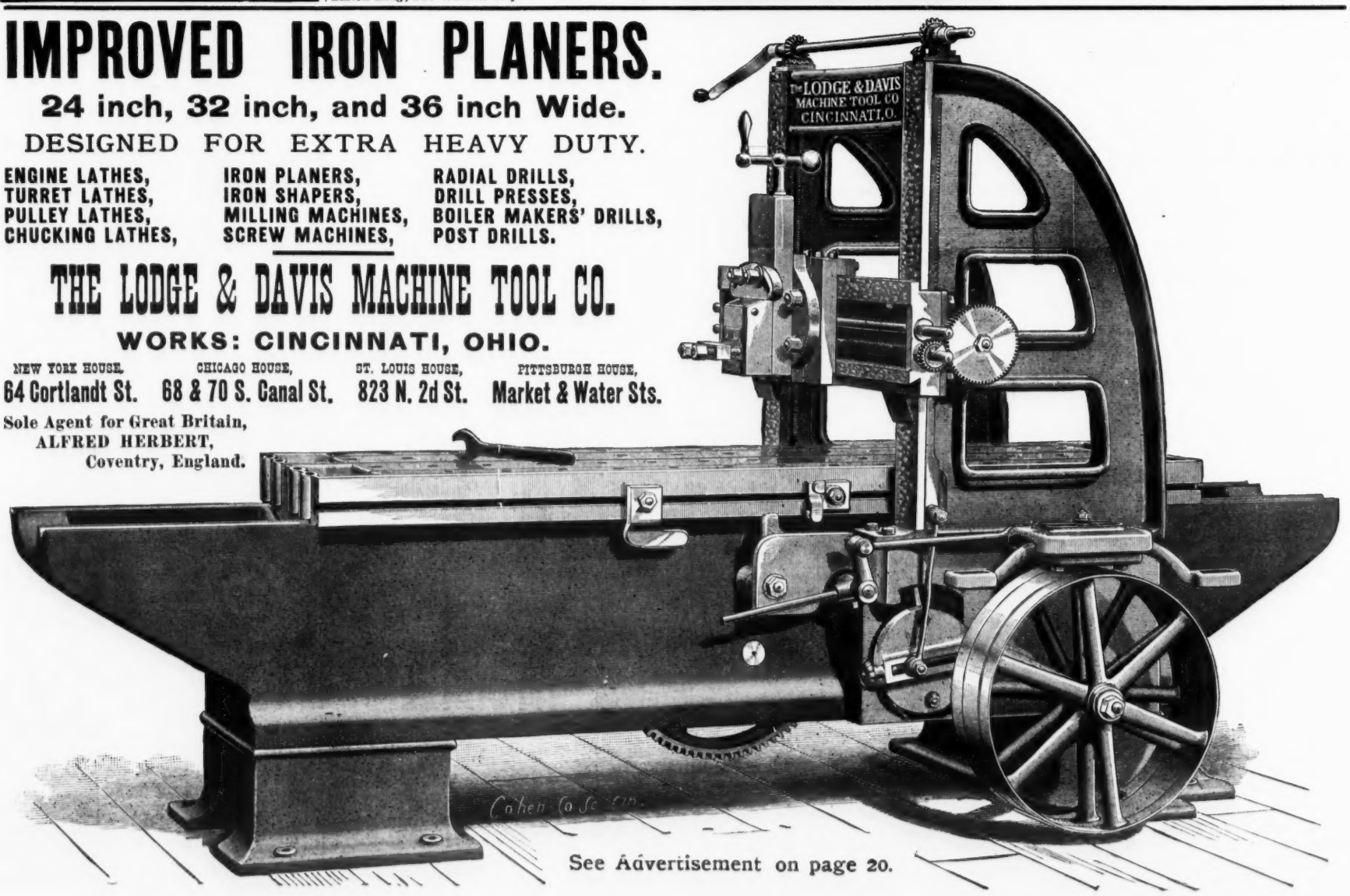

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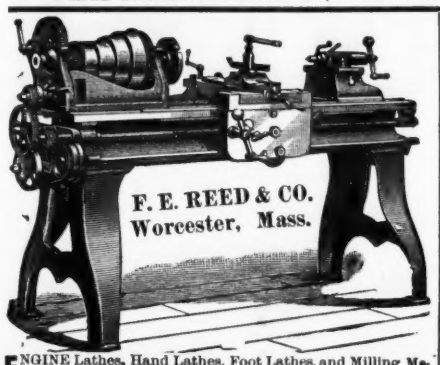

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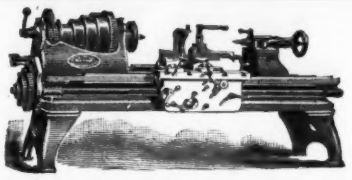

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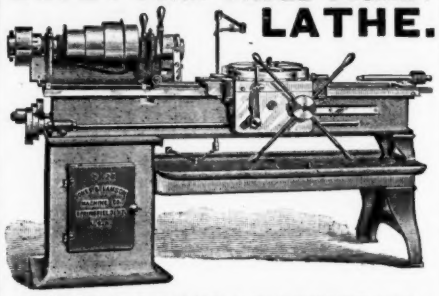

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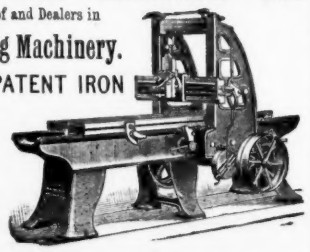

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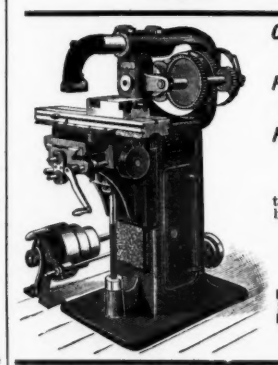

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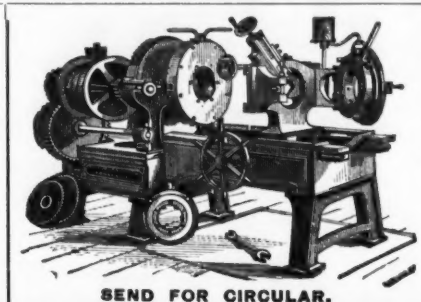

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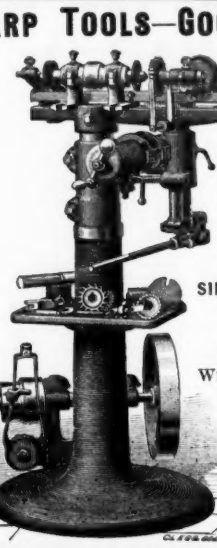

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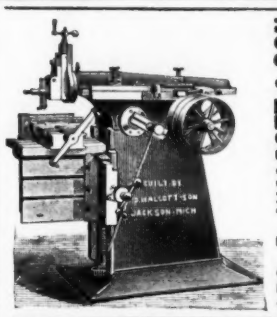

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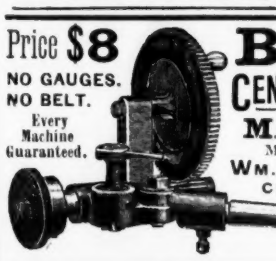

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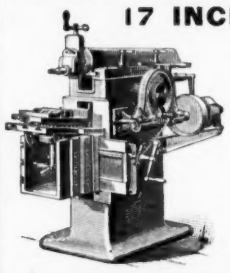

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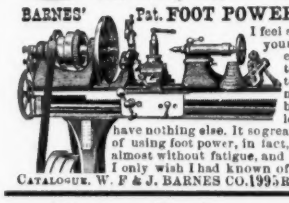

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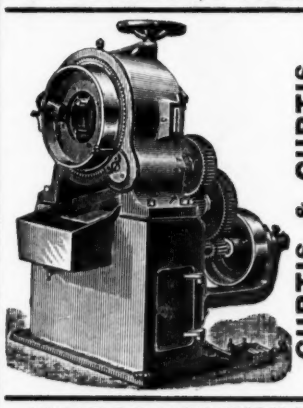

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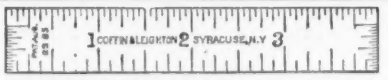

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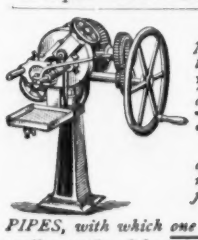

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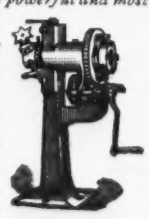

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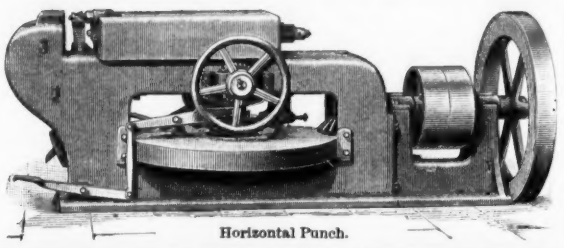
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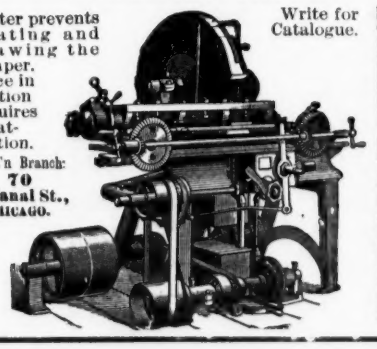
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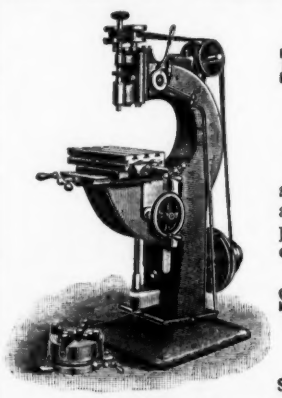
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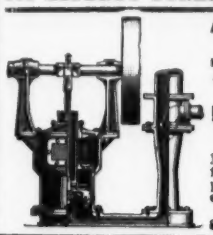
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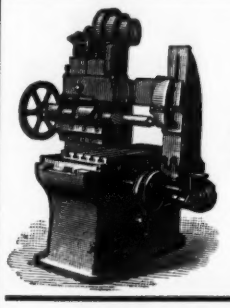
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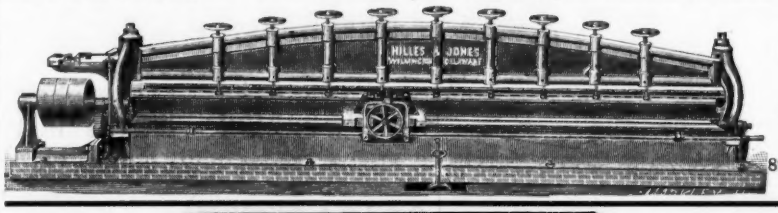
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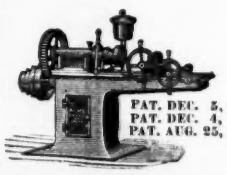
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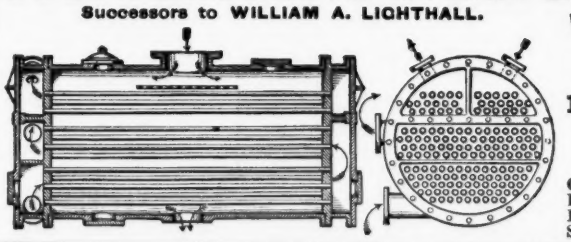
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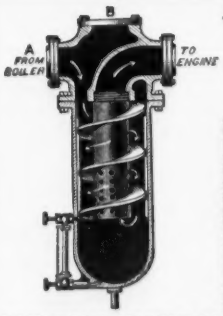

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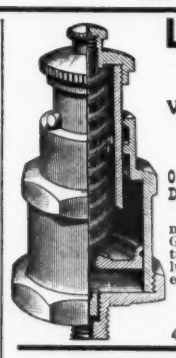
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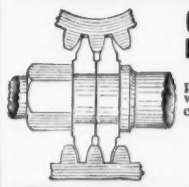
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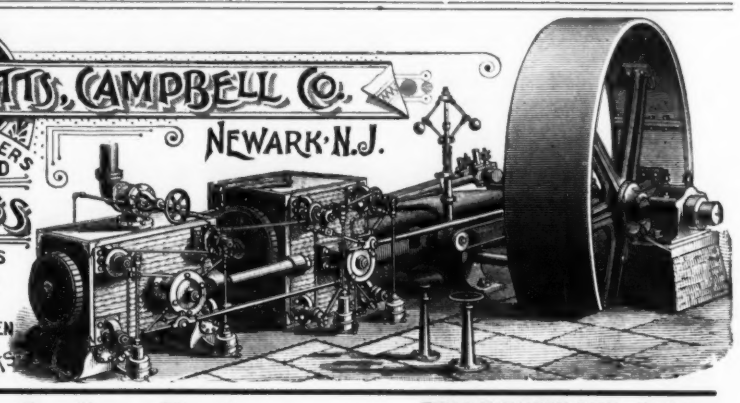

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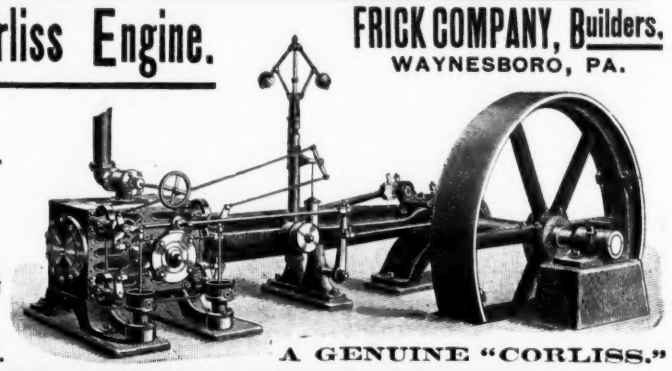

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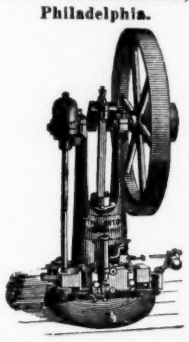

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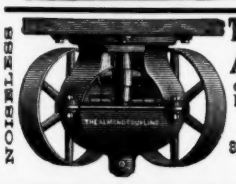

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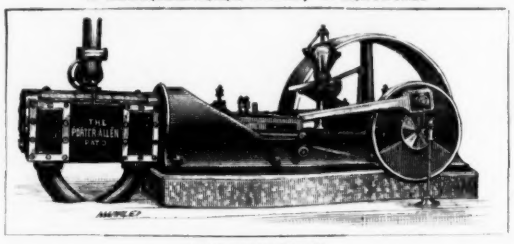

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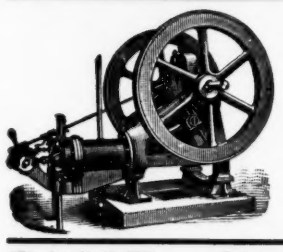

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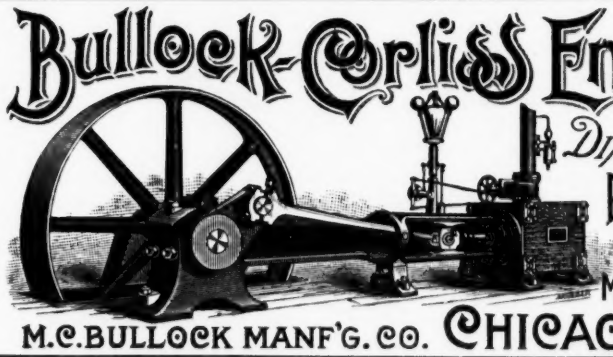

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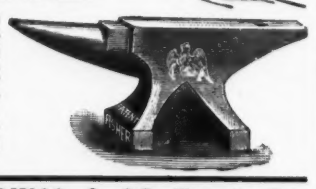

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FOR PATTERN MAKERS. 8 Sizes.
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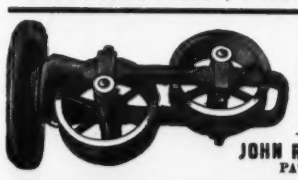

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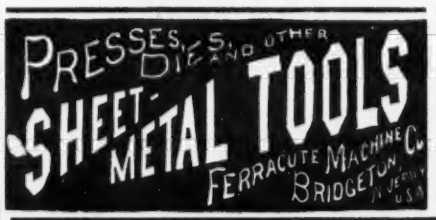

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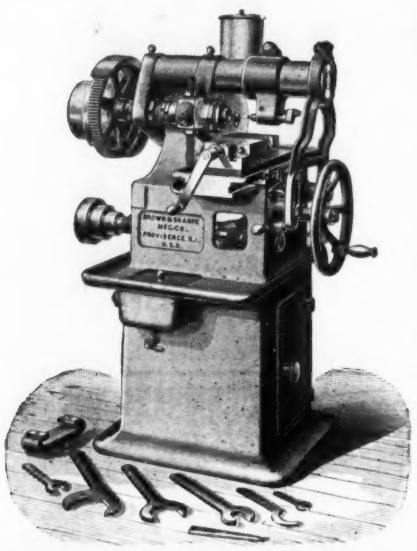
After May 6th, the business, firm name and good will of CHAS. H. VINCENT & CO., who for the past three years have had the agency of Ball Engines in the East, will be acquired by THE BALL & WOOD COMPANY. Mr. Vincent will become its Secretary, and Mr. Smith have charge of its interests at Cincinnati.

FRANK H. BALL, V. Prest. and Gen'l Manager. THOMAS C. WOOD, President.



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No. 2 PLAIN MILLING MACHINE.

The greatest distance from the center of spindle to top of table is 6 inches; the least distance, 2 7-16 inches.

The Table is 28 inches long, 9½ inches wide. The platen, to which the work is secured, is 19 inches long and six inches wide. The total length of feed, 17½ inches. Weight, 1900 lbs. Floor space, 45x45 inches.

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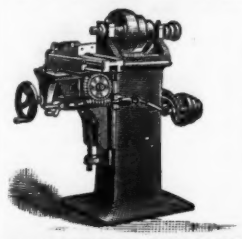

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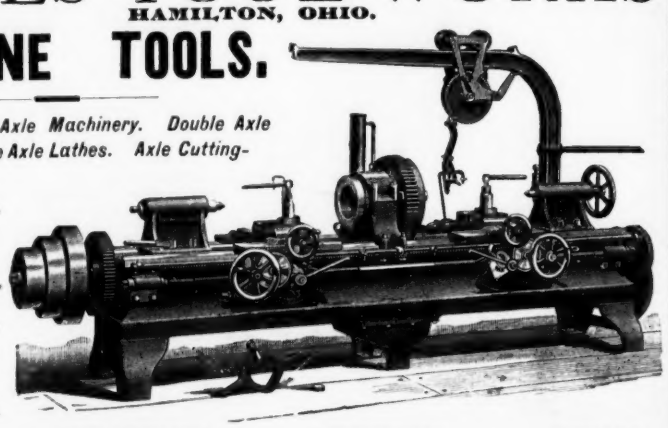

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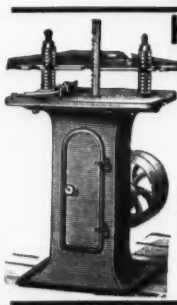

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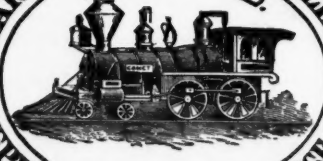

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N. B.—See "Advertisement," page 16.

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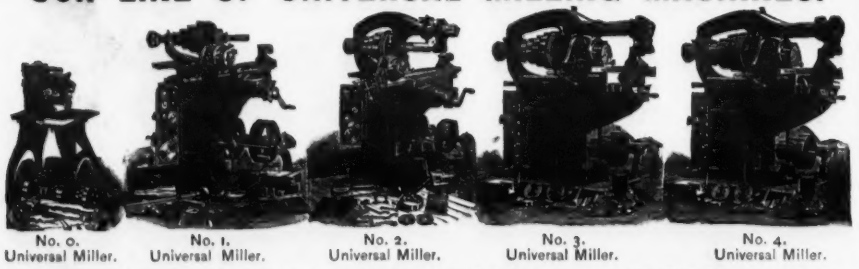

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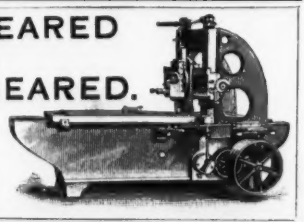

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